HSE
Health & Safety Executive

THE
UNITED KINGDOM's THIRD NATIONAL REPORT
ON
COMPLIANCE WITH
THE CONVENTION ON NUCLEAR SAFETY
OBLIGATIONS

Revision 3, September 2004

Contributors to the UK 's National Report

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FOREWORD

This report has been prepared by the United Kingdom (UK) to meet the requirement of Article 5 of the Convention on Nuclear Safety. It considers each of the Convention's obligations and explains how the UK addresses them.

The report only covers land based civil nuclear power plant as defined in Article 2 of the Convention. The safety of other UK nuclear facilities outside the scope of the Convention are also regulated and operated in a manner that maintains a high level of safety.

The UK has no nuclear installations where significant corrective actions were necessary to comply with the Convention. This is because of the effectiveness of the UK's nuclear safety licensing regime, the high priority given to safety by the UK nuclear utilities and the good safety culture in the industry. Also the periodic safety review requirements of the UK nuclear site licences has meant that for many years the UK has been monitoring and improving the safety of its nuclear installations. This activity will continue in the future.

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INTRODUCTION

Structure of Report

1.1 This report explains how the nuclear installations in the UK achieve the high safety standards required by the Convention on Nuclear Safety. To enhance the information presented in the report, the UK has used the IAEA Safety Standard Requirements to demonstrate that all the important safety topics have been considered. The report uses the Articles of the Convention (6-19) as main headings and the detailed requirements of each Article as sub-headings. For each sub-heading the relevant requirements of the IAEA Safety Standard have been identified and reproduced in a text box at the appropriate point in the report. The report then demonstrates how the UK complies with the IAEA requirement. Where it seems to be appropriate, more detailed information and data has been placed in Annexes at the end of the report. References to sources of the information used are identified thus: [xx] and listed from page 148.

1.2 The IAEA Standards used are as follows:

- GS-R-1: Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000)
- GS-R-2: Preparedness and Response for a Nuclear or Radiological Emergency (2002)
- 50-C/SQ-Q: Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations (1996)
- NS-R-3: Site Evaluation for Nuclear Installations (2003)
- 115: International Basic Safety Standards for Protection against Ionising Radiation and for the Safety of Radiation Sources (1996)
- NS-R-1: Safety of Nuclear Power Plants: Design (2000)
- NS-R-2: Safety of Nuclear Power Plants: Operation (2000)

The reference number at the beginning of each IAEA requirement cited in the text refers to the assigned IAEA standard number and that part of the standard that states the specific requirement.

National policy towards nuclear activities

1.3 The Government's Department of Trade and Industry (DTI) sponsors the nuclear industry in the UK. Two companies carry out commercial nuclear power generation. British Energy plc (BE) is a private sector company and Magnox Electric plc (ME), wholly owned by BNFL, is in the public sector. BE, the larger of the two, is a holding company with two subsidiaries. British Energy Generation Ltd. (BEGL) operates the Pressurised Water Reactor (PWR) and five Advanced Gas Reactor (AGR) stations in England. British Energy Generation (UK) Ltd (BEG(UK)L) operates two AGR stations in Scotland. Magnox Electric owns and operates five Magnox stations in England, Wales and Scotland. The Health and Safety Executive (HSE) is the UK's nuclear installation licensing authority and regulates safety at all nuclear installations in the UK (see Article 8).

1.4 The UK Government's energy policy is to ensure secure, diverse and sustainable energy at competitive prices. The Government frequently reviews a number of policy areas (for example, energy sources for power generation and utility regulation) to ensure that these continue to contribute to that broader objective.

1.5 During 2003, (the latest date for which a figure is available in the Digest of United Kingdom Energy Statistics 2004[1]) nuclear power provided 15.4% of the installed electricity generating capacity in the UK. In terms of actual electricity supplied, nuclear power accounted for 22% of the UK's electricity output. Provided that UK's Nuclear Power Stations continue to maintain their existing high standards of safety and environmental protection, the Government believes that nuclear power should continue to contribute to the UK's electricity supply industry.

1.6 The UK has no plans to build any new nuclear power plants but the government has indicated that the nuclear option should remain open.

Recent and Current Nuclear Safety issues at UK Nuclear installations

1.7 The UK has no nuclear installations where significant corrective actions were necessary to comply with the requirements of this Convention. This is because of the effectiveness of the UK's nuclear safety licensing regime, the high priority given to safety by the UK nuclear utilities and the good safety culture in the industry. Also the periodic safety review requirements of the UK nuclear site licences has meant that for many years the UK has been monitoring and improving the safety of its nuclear installations. This activity will continue in the future.

1.8 The following paragraphs summarise the key issues at each of the UK's Nuclear Power Stations. This section includes statements on significant incidents that have occurred since the previous report on the CNS. The definition of a significant incident is one that meets the reporting requirements of the Secretary of State (see Article 19). Further technical details on the reactors at each site are shown at Annex 1.

Calder Hall (4 Magnox reactors)

1.9 This station is no longer operating. Since the end of electricity generation in March 2003, a programme of modifications to improve the safety of the fuel route has been instigated to prepare for defuelling that will commence in April 2005.

Chapelcross (4 Magnox Reactors)

1.10 The decision to permanently cease generation at Chapelcross took effect on 29 June 2004 and the site is now preparing for defuelling

Bradwell (2 Magnox Reactors)

1.11 This station ceased operation in January 2003 and is currently being defuelled

Hinkley Point A (2 Magnox Reactors)

1.12 This station ceased operation in 2003. It has maintained good progress in defuelling both reactors and is ahead of the programme. ME is anticipating completing the defuelling of both Reactors by around December 2004. The Station is aiming to empty the ponds of fuel and verify that all fuel has been removed from the site by April 2005.

Dungeness A (2 Magnox Reactors)

1.13 Dungeness A has been operating for 37 years and is planned to cease generation in December 2006. Magnox Electric has implemented many safety improvements following a Long Term Safety Review in the 1980s and a Periodic Safety Review in 1995. There are redundant and diverse safety provisions such that the design basis faults can be tolerated. Very few large plant safety upgrades are planned between now and the end of generation but general plant condition improvements are still attracting investment. The refurbishment of the fuel route is under way to support defuelling which is planned to take place between 2007 and 2009. A further Periodic Safety Review has recently commenced to justify plant safety for the ten-year period beyond 2006, including post-operation safety issues.

Sizewell A (2 Magnox reactors)

1.14 Sizewell A has been operating for 37 years and is planned to cease generation in December 2006. Magnox Electric has implemented many safety improvements following a Long Term Safety Review in the 1980s and a Periodic Safety Review completed in 1995. There are redundant and diverse safety provisions such that the design basis faults can be tolerated. Very few large plant safety upgrades are planned between now and the end of generation but general plant condition improvements are still attracting investment. The refurbishment of the fuel route is under way to support defuelling which is planned to take place between 2007 and 2009. A further Periodic Safety Review has recently commenced to justify plant safety for the ten-year period beyond 2006 that will include post generation safety issues. One reactor on this twin reactor station was shut down in March 2004 as a result of a major failure of a generator transformer. It is planned that a new transformer will be installed in November 2004. The failure did not affect nuclear
safety related plant.

Oldbury (2 Magnox reactors)

1.15 Oldbury has been operating for 35 years and is planned to cease generation in 2008. Magnox Electric has implemented many safety improvements following a Long Term Safety Review in the early 1990s and a Periodic Safety Review that was completed in 1997. There are redundant and diverse safety provisions such that the design basis faults can be tolerated. Magnox Electric has completed structural modifications to the plant to ensure that the control block and irradiated fuel storage pond buildings are seismically qualified

Wylfa (2 Magnox reactors)

1.16 Wylfa has been operating for 33 years and is planned to cease generation in 2010. Magnox Electric has implemented many safety improvements following a Long Term Safety Review in the 1990s and a Periodic Safety Review that was completed in 2003 with some follow up work still ongoing. The follow up work includes reinforcing structures to

withstand seismic loading, updating the safety case for the primary pressure circuit penetrations and implementing a number of other safety modifications. There are redundant and diverse safety provisions such that the design basis faults can be tolerated.

Dungeness B (2 AGR reactors)

1.17 In January 2002 British Energy Generation Ltd. (BEGL) reported two events that had each led to water leaks from joints in large diameter pipes of the Dungeness B Water Spray Fire System. In both cases, the system was removed from service to enable the leaks to be repaired. As the Water Spray Fire System protects safety-related equipment from fire, the reactors were shut down to maintain nuclear safety. The nuclear safety regulator, the Health and Safety Executive's (HSE's) Nuclear Installations Inspectorate (NII) Site Inspector's initial investigation raised a number of concerns with respect to the adequacy of the Water Spray Fire System. A Direction to review and reassess safety was issued under Licence Condition 15(4). The results of this were reported to NII by the end of March 2002 as required. BEGL has already made some improvements to the system.

Hunterston B (2 AGR reactors)

1.18 In view of the problems presented by the cast iron pipework at Heysham 1, and in common with the rest of the British Energy nuclear installations, the station has undertaken an extensive exercise to establish the condition of the installed cast iron pipework. A complete asset register of the remaining cast iron pipework with detailed pipe layout drawings has been produced. Currently, non-destructive testing has not identified concerns.

Heysham 1 (2 AGR reactors)

1.19 Heysham 1 was shut down on 28 October 2003 following the failure of a section of cast iron pipework within the Essential Cooling Water (ECW) system, leading to some flooding of the turbine hall basement and water ingress to the reactor basement. The cast iron pipework was known to be in a degraded condition from corrosion by the seawater it carries and was undergoing a phased programme of replacement with glass-coated steel piping at the time of the incident. The reactor will not be allowed to operate until the regulator is satisfied that this can be undertaken safely.

1.20 BEGL reported an event at Heysham 1 on 11 March 2004 involving a fuelling machine operation at a Fuel Storage Tube. The machine had collected a new fuel assembly from the tube and had replaced this with a short shield plug. Unknown to the operators, and contrary to the indications at the fuelling machine, the shield plug had not disconnected from the machine grab. A mechanical interlock designed to prevent the machine moving until safe to do so had failed. This allowed the machine to move sideways which resulted in impact between the shield plug and the storage tube. The shield plug was severed into two parts with the lower part falling into the storage tube.

1.21 The NII Site Inspector visited the site within a few hours of the event being reported. He confirmed that the nuclear safety significance of the actual event was low, but that it could have been more serious if the fuelling machine had been operating at the reactor. There are, however, other interlocks to provide protection in this case. He also confirmed that a full investigation was underway and that the refuelling safety case would be revalidated before the machine was used again over the reactor. The event was subsequently categorised as a "level 2" event (an incident) on the International Nuclear Event Scale (INES) of nuclear events, due to the implications of multiple failures of safety provisions.

1.22 NII has closely scrutinised the licensee's investigation and safety case revalidation process. NII also used our regulatory powers to prevent the refuelling machine being returned to service without our agreement. NII eventually allowed BEGL to return the machine to service following an assessment of the revalidated safety case. NII continues to monitor the longer term actions arising from the event as part of our routine regulatory business

Torness (2 AGR reactors)

1.23 The sudden and extensive failure of a gas circulator at Torness in May 2002 was thought, from forensic evidence, to be linked to the development of an unexpected fatigue related crack in part of the impeller. In August, another gas circulator on the other Torness reactor showed signs of increasing vibration and was promptly shut down by the operators. Its subsequent disassembly revealed a fully developed fatigue related crack in a similar position to the first failure, but the prompt shut down had prevented consequential damage.

1.24 Following the initial failure, BEGL increased the attention given to circulator vibration monitoring. As a result of the second failure, more extensive routine monitoring of circulator characteristics is being undertaken and more extensive circulator monitoring equipment is being fitted to allow efficient, cross-fleet monitoring of circulator behaviour. Activities in this area are being brought up to best practice standards.

1.25 Inspectors from HSE's NII monitored the recovery of the first failed circulator and its examination by BEGL specialists, and BEGL's examination of the fixed structure for any signs of damage. Agreement to replace the failed generator was given by HSE when it was satisfied that there was no structural damage to the reactor. As the second failure did not result in the disintegration of the circulator impeller there was no damage to the reactor structure.

1.26 With the discovery of a systematic and comparatively frequent failure mechanism, safety concerns increased and NII required a revised and extended safety case to cover operations. This incorporated forewarning of failure by early and effective detection of changes in vibration patterns, together with recognition of the need to shut down any affected circulators before major failure and consequential challenge to the circulator casing occurs.

1.27 British Energy Generation (UK) Ltd. (BEG(UK)L) has inspected all gas circulator impellers in service at Torness and found no evidence of developing defects. Only a limited number of impellers have been inspected at Heysham 2, but again no defects have been found. BEGL and BEG(UK)L have provided acceptable interim safety cases justifying continued operation of the reactors at Torness and at its sister station Heysham 2, and will produce, in the spring of 2003, final safety cases incorporating all the findings from its inquiry into the failures and changes introduced in the light of the events at Torness.

Sizewell B (1 PWR reactor)

1.28 Indications of cracks were seen in the Inconel 600 pressure vessel head penetrations. BEGL has agreed crack size and growth criteria with the regulator and these findings are as expected. BEGL is preparing a programme for the replacement of the RPV head with one containing Inconel 900 penetrations.

1.29 The Periodic Safety Review for Sizewell B is on time to align with the 10-year outage in September 2005.

Information requested by Second Review Meeting Relevant to Articles 6 to 19

1.30 The Summary report of the CNS second Review Meeting held in April 2002 raised a number of specific and general issues to be addressed in countries' third reports. Those applicable to the UK are considered below. The relevant paragraphs from the 2002 Summary report are repeated in italics.

Observations on factors of special interest

(18) In situations where a nuclear power plant is scheduled to shut down in a few years time, appropriate measures have to be taken by, and resources provided to, both the operator and the regulator to ensure operational safety until closure. Contracting Parties were invited to report on the evolution of such situations at the next Review Meeting.

1.31 The operators and regulator have recognised this as a potential problem for a number of years. Resources have been and continue to be available to ensure operational safety until closure and beyond. Licence condition 36 (see Annex 5) is used to ensure that adequate resources are maintained.

Observations on the legislative and regulatory framework (Articles 4, 7 and 9)

(20) Contracting Parties were invited to provide further information in their next National Reports on development of new, or changes in, legislative and regulatory frameworks.

1.32 The text for Articles 7 and 9 provides an update on position in the UK with respect to its legislative and regulatory framework and the responsibility of the licencee.

Observations on the regulatory body (Article 8)

(23) Some Contracting Parties explained the use of technical support organizations (TSOs) to perform some assessment tasks on behalf of the regulatory body. In this respect, some Contracting Parties reported that their regulatory bodies do not have TSOs of their own. In these cases, a point of interest to be reported on at the next Review Meeting is how such regulatory bodies obtain adequate expertise without conflict of interest.

1.33 The nuclear safety regulator in the UK does not use TSOs. Most of the expertise to regulate nuclear safety is available to the regulator through its own staff. To maintain this situation, the regulator periodically reviews its expertise and its likely needs for the near and intermediate term and adjusts its recruitment and training activities accordingly. There are occasions however when specialist advice and/or additional resource are needed to respond to a high workload. To accommodate this, the regulator has an extramural support budget and framework agreements, with some outside bodies known to be independent, to enable contracts to be placed quickly.

(24) It was reported that modernisation programmes helped in maintaining and increasing staff competence and motivation. Several Contracting Parties reported on the issue of maintaining competence of the regulatory body in the light of competitive job markets and the retirement of competent staff. This issue is even more important in cases where nuclear energy programmes are stagnating or declining. Contracting Parties were invited to provide further information in their next National Reports on maintaining competence and motivation of staff needed for safe regulation and operation of nuclear installation.

1.34 This is covered under Article 19 (paragraphs 19.25 – 19.28)

(25) For some Contracting Parties questions as to the effective independence and administrative position of their Regulatory Bodies are still relevant. Further information would be welcome on the independence achieved, "de facto" and "de jure".

1.35 How the UK achieves independence of its nuclear safety regulatory body is described under Articles 7 and 8.

(26) The status and position of regulatory bodies remains an important topic to be dealt with in future National Reports and Review Meetings. Although improvement was reported in the human and financial resources of regulatory bodies, further attention should be given to this issue.

1.36 These issues are addressed under Article 8 and Annex 6.

(27) Contracting Parties reported on their national regulatory strategies. Some Contracting Parties reported on using probabilistic safety assessment (PSA) as an additional tool in optimising their regulatory or inspection activities and some reported on their use of different performance indicators, whether they be quantitative or qualitative, to monitor the safety of their nuclear installations. The advantages and limitations of regulations of a detailed prescriptive nature as compared to less prescriptive, goal oriented approaches and the complementary use of risk assessments were discussed. Contracting Parties agreed to review their experience and report at the next Review Meeting.

1.37 The use of deterministic and probabilistic assessments in the UK is discussed under Article 14.

(31) Contracting Parties were invited to provide further information in their next National Reports on international co-operation on a bilateral and multilateral, basis among regulatory bodies.

1.38 The UK utilities play a full role in international activities. UK nuclear installation licensees have for many years participated in assistance programmes for the utilities in Central and Eastern Europe anfd the former Soviet Union. BNFL currently project manage the DTI assistance programme. UK nuclear installation licensees also participate as appropriate in the work of IAEA and NEA.

1.39 The UK's nuclear safety regulator spends approximately 3% of its resource on international co-operation activities. Currently HSE gives the highest priority to the IAEA work on Standards Development and the to the Western Nuclear Regulators Association (WENRA) work on the harmonisation of European regulatory practises. It also participates in

the work of OECD Nuclear Energy Agency (NEA) and the European Commission (EC). For many years HSE has participated in EC sponsored assistance programmes to Central and Eastern Europe and the former Soviet Union. The NSD director is a member of the International Regulators Association, the Chair of the IAEA Commission on Safety Standards and on several advisory groups advising the European Bank on reconstruction and development. HSE has several active bilateral agreements.

(32) Contracting Parties would welcome additional information in the next National Reports regarding maintaining and enhancing the competence of regulatory bodies.

1.40 This issue has been addressed above and under Article 8 and Annex 6.

(33) It was noted that there is a trend towards implementation of quality management systems in regulatory bodies. Contracting Parties would welcome further information on this topic at future Review Meetings.

1.41 The UK's nuclear safety regulator continues to strive for improvements in its effectiveness and efficiency through its use of the European Foundation for Quality Management model and programme. It is developing a detailed improvement programme for the next period based on both internal and external reviews. Additionally, bilateral and multilateral contacts with other countries' regulators continue to provide very valuable feed into the improvement programme by benchmarking against other nuclear safety regulators. The Regulator has a comprehensive suite of procedures, the Business Management System (BMS). The adequacy of, and compliance with the BMS is systematically audited both internally and externally. Further information can be found under article 8 paragraphs 8.28 – 8.29.

Operating nuclear installations (Articles 6, 10,12, 13 and 19)

(38) Several Contracting Parties reported on important events that occurred in their nuclear installations since the first Review Meeting, and the resulting lessons shared with other Contracting Parties. It was noted that a large contributor to these events was related to human performance and organizational issues. Contracting Parties were invited to provide further information in their next National Reports on important events in their nuclear installations.

1.42 Paragraphs 1.7 to 1.32 summarise the key events at each of UK's nuclear installations. This includes a summary of significant incidents. Paragraph 1.17 (Dungeness B), paragraphs 1.21 –1.24 (Heysham 1) and paragraphs 126 – 130 (Torness) all report incidents that met the UK Secretary of State reporting requirements (see also Article 19). .

(41) Contracting Parties would welcome additional information in the next National Reports regarding the content of safety review processes for plant life extension and conclusions of the review(s).

1.43 Article 6 provides information on the UK's safety review processes (PSRs) and references reports containing conclusions and other information on this issue. It should be noted that the purpose of the PSR is not specifically to extend the operating life of a reactor. In the UK, operating life is not defined at the start of operation. The PSR process provides a

comprehensive review of safety and a look forward for a further 10 years to the next review. A satisfactory review would permit a reactor to operate for a further 10 years subject to specific condions arising from the review and subject to the outcome of routine regulation.

(42) Measures for severe accident management are in various stages of development and implementation in many Contracting Parties. It was noted that different approaches are used, e.g. with regard to improving the capability of the containment to cope with severe accidents. Further information on the details and actual experience with these different approaches would be welcomed in the next National Reports.

1.44 This issue has been addressed under Article 16 and Annex 9

(44) Further and more detailed information on the status of safety improvement programmes would be welcomed in the next National Reports.

1.45 This issue has been addressed under Article 6.

Financial and human resources - national infrastructure (Article 11)

(45) It was noted that a sound economic basis for the nuclear utility owning and operating the plant is a prerequisite for financing an effective safety programme. In the present changing energy market in many countries, it is important that utility managers as well as regulatory bodies understand the potential effects on safety of severe financial constraints.

1.46 This issue is well understood in the UK as the nuclear utilities have been operating in a deregulated electricity market for many years. Licence condition 36 (Annex 5) is used to ensure that licensees maintain adequate resources to ensure safety. More information on this matter will be provided by the UK during its presentation at the third Review Meeting.

Assessment and verification of safety (Articles 14,17 and 18)

(50) Contracting Parties were invited to provide further information in their next National Reports on their use of PSA.

1.47 The issue of the use of PSAs is addressed under Article 14.

Radiation protection (Article 15 and 19 (viii))

(57) Contracting Parties would welcome an update on the evolution of trends in occupational doses and releases to the environment and on exchange of online monitoring data in the next National Reports.

1.48 Occupational dosed are addressed under Article 15. Releases of radioactivity to the environment in the UK were dealt with under the Joint Convention's UK national report and first Review Meeting of that convention.

Observations on emergency preparedness (Article 16 and 17 (iv))

(61) In the next National Reports, information would be welcomed on improvements made in the area of emergency preparedness, including the results of national and international exercises.

1.49 Emergency preparedness issues are addressed under Article 16 and its associated Annex 9.

Final conclusions and recommendations

(64) Commitments have been made by Contracting Parties to complete the important safety improvements identified in the review process as planned. As described earlier in this report, other areas that warrant special attention include: safety management and safety culture; plant ageing and upgrading; maintaining competence; and effectiveness of regulatory practices.

1.50 These issues are discussed at various points in this report. Article 12 addresses safety management and safety culture, Article 6 adresses plant ageing and upgrading in the context of periodic safety reviews, Article 11 addresses the problems on maintaining competence and article 8 discusses the position in the UK regarding measuring the effectiveness of regulatory practises.

ARTICLE 6. EXISTING NUCLEAR INSTALLATIONS

The text of Article 6 is:

"Each Contracting Party shall take the appropriate steps to ensure that the safety of nuclear installations existing at the time the Convention enters into force for that Contracting Party is reviewed as soon as possible. When necessary in the context of this Convention, the Contracting Party shall ensure that all reasonably practicable improvements are made as a matter of urgency to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shutdown may take into account the whole energy context and possible alternatives as well as the social, environmental and economic impact."

Nuclear installations in the UK

6.1 The UK's nuclear licenced sites with NPPs are listed below. This includes those sites with reactors that have shut-down, are defuelling or are decommissioning. With the exception of Sizewell B (which is a pressurised water reactor (PWR)) all the UK's nuclear power plants use gas-cooled technology. The first generation (Magnox) use natural uranium with magnesioum alloy cladding. The second generation (AGRs) use uranium dioxide fuel. It is expected that all Magnox reactors will be shut down by 2008. The Government is establishing a new public body, the Nuclear Decommissioning Authority (NDA) that will take ownership of the
Magnox nuclear installations in 2005.

(i) BNFL plc and Magnox Electric plc:

Berkeley	- 2 Reactors (Magnox)	decommissioning
Hunterston A	- 2 Reactors (Magnox)	decommissioning
Trawsfynydd	- 2 Reactors (Magnox)	decommissioning
Calder Hall	- 4 Reactors (Magnox)	shut down
Chapelcross	- 4 Reactors (Magnox)	shut down
Bradwell	- 2 Reactors (Magnox)	defuelling
Dungeness A	- 2 Reactors (Magnox)	
Hinkley Point A	- 2 Reactors (Magnox)	defuelling
Oldbury	- 2 Reactors (Magnox)	
Sizewell A	- 2 Reactors (Magnox)	
Wylfa	- 2 Reactors (Magnox)	

(ii) British Energy plc (British Energy Generation Ltd. in England and Wales, and British Energy Generation (UK) Ltd. in Scotland):

Dungeness B	- 2 Reactors (AGR)
Hartlepool	- 2 Reactors (AGR)
Heysham 1	- 2 Reactors (AGR)
Heysham 2	- 2 Reactors (AGR)
Hinkley Point B	- 2 Reactors (AGR)

Hunterston B	- 2 Reactors (AGR)
Torness	- 2 Reactors (AGR)
Sizewell B	- 1 Reactor (PWR)

Further details and key parameters for the operational nuclear installations are given in Annex 1.

6.2 The UK's first nuclear installations, the Magnox reactors, started operation between 1956 and 1971. These are carbon dioxide gas cooled, graphite moderated reactors that use natural uranium fuel in a magnesium alloy cladding. The first nine installations had steel reactor pressure vessels, but the last two stations at Oldbury and Wylfa had prestressed concrete reactor pressure vessels. These later designs had significant safety advantages over the steel pressure vessels since a sudden and unexpected failure of the pressure boundary was deemed to be virtually impossible. However, the natural uranium magnesium alloy cladding limited the development of the Magnox technology regarding increasing power density and gas outlet temperature.

6.3 The second generation of gas cooled reactors were the AGRs. Seven stations were commissioned between 1976 and 1988 each with 2 reactors. AGRs use enriched uranium oxide fuel in stainless steel cladding. This, together with the prestressed concrete pressure vessel, allowed gas outlet temperatures of over 600
degrees and gas pressures of over 30 Bar.

6.4 The UK's gas cooled reactors do not need secondary containment. For design basis loss of coolant accidents, the reactor transient does not precipitate largescale fuel failure. The plant is designed to be capable of retaining the bulk of the radioactive material that might be released from the fuel for the entire range of accidents considered in the design. In contrast, containment buildings are required for Pressurised Water Reactors and Boiling Water Reactors because a design basis loss of coolant accident results in significant fuel failure and release of radioactive fission products.

6.5 The last nuclear power plant to be built in the UK is the PWR at Sizewell B. This became operational in 1995. This reactor uses enriched uranium oxide fuel clad in Zircalloy and pressurised water as the coolant.

6.6 Paragraphs 6.1 to 6.5 show that UK has a wide range of nuclear plant with a range of designs that span nearly 50 years. Although not specifically an issue for the Convention on Nuclear Safety, the unique designs of the UK plant has required the development of fuel manufacture and reprocessing facilities as well as research organisations. It was essential therefore that the UK had regulatory processes in place to ensure that all plants continued to be safe and were upgraded as necessary to meet current safety standards as well as fulfilling the requirements of Article 6 of this Convention. The following paragraphs demonstrate how UK meets the requirement of this article.

Safety Reviews and upgrading of Nuclear Installations in UK

6.7 The safety of UK's Nuclear Power plants is assured by the process of routine regulation and inspection (as addressed under Article 8 of this Report) and by the process of Periodic Safety Reviews (PSRs).

6.8 The main PSRs are carried out every 10 years. However intermediate reviews are carried out at more frequent intervals and any identified necessary upgrading measure are implemented.

6.9 Each nuclear power reactor is required to shut down for inspection and maintenance every two or three years (depending upon the particular NPP design). After these shutdowns, the licensee must apply for a Consent (see Annex 2) to restart the reactor. Consents are granted by the regulator, HM Nuclear Installations Inspectorate (NII) which is part of HSE's Nuclear Safety Directorate, following a satisfactory review of the licensee's inspection and maintenance programme, the operational performance of the station since the previous start-up Consent and a satisfactory review of the safety case. These start-up reviews give the NII the opportunity to review specific aspects known to have safety significance. In addition, Consent for start up is not granted until NII is sufficiently confident that the reactor is safe to operate for the period up to the next shut down for inspection and maintenance.

6.10 Any safety concern on one reactor may have implications for other reactors on the site or indeed for the family of reactors with similar features. If such concerns are raised either during a maintenance outage or during normal operation, the HSE has powers to require the operators of the reactor, or similarly affected reactors, to take remedial action including shutting down if this is appropriate. In this latter situation the operator must again apply to NII for a Consent to restart. Further information concerning the statutory requirements and the operation of NII are given under Articles 7 and 8.

6.11 In addition to the continual day-to-day regulatory inspection and assessment of Licensees' activities and the shutdowns, there are Periodic Safety Reviews (PSRs) where reappraisals are done not only to confirm continued operation but also to examine plant safety in the foreseeable future. The UK approach to PSRs is covered in the following section.

Periodic Safety Reviews

6.12 The UK has been undertaking safety reviews of the UK's civil nuclear installations for many years as part of the regulatory process. There has been a requirement for PSRs since the introduction of the standard nuclear site licence in 1990. All nuclear installations are required to undertake a major safety review every
10 years.

NS.R.2, 10.4: The scope of the PSR shall include all safety aspects of an operating plant, including both on-site and off-site emergency planning, accident management and radiation protection aspects.

6.13 All Nuclear Power Stations are subject to PSRs as part of the Licence requirements. The programme for the UK's nuclear installations' PSRs is given in Table 6.1 below. The reviews are submitted to HSE for consideration and assessment to evaluate whether an adequate level of safety has been achieved. The PSRs have been completed to an agreed programme and will be repeated at 10-year intervals. The outcome of the first of the AGR PSRs, for the Hinkley Point 'B' and Hunterston 'B' nuclear power stations, was reported by HSE in 1997[2]. This was followed by the PSRs for Dungeness 'B' in 1998 [3] and Heysham 1 and Hartlepool in 1999[4]. Finally, the results of the PSRs on Heysham 2 and Torness were published in 2002[5]. Although all Magnox Stations will be closed down by 2008, the requirement for a PSR still stands to cover post-operational safety.

6.14 HSE typically reports on the out come of the PSRs under the following headings:

- Review of Operating Experience
- Reactor Safety Systems
    - Fault Studies and safety analysis
    - Reactor shutdown systems
    - Post-trip cooling
    - Electrical supplies
    - Safety related instrumentation
- Reactor Pressure Boundary
    - Reactor pressure vessel and foundations
    - Liner, penetrations and insulation
    - External gas circuits
    - Standpipes
    - Pressure vessel cooling water system
- Reactor Internals
    - Graphite core
    - Steel structures
    - Gas baffle assembly
    - Boiler internals
- Human Factors
- Operating Rules
- Natural and Other Hazards
    - Resistance to earthquakes
    - Steam and gas release
    - Fire
    - Other hazards, including flooding
- Fuel Handling and Cranes
    - Refueling equipment
    - Cranes
- Waste and Spent Fuel Management
- Ageing
- Radiation Doses
    - Doses to on-site workers

    - Doses to the public
- Station Safety Case

Table 6.1 Status of Periodic Safety Reviews

STATION	STARTED OPERATION	FIRST REVIEW	SECOND REVIEW	THIRD REVIEW
Magnox Installatons				
Bradwell	1962	1987	1992	Closed
Berkeley	1962/3	1988	Closed	
Hunterston A	1963	1988	Closed	
Calderhall/Chapelcross	1956/59	1982	1990	Closed
Trawsfynydd	1964	Closed		
Hinkley Point A	1965	1990	1995	Closed
Dungeness A	1966	1994	1996	Closes 2006
Sizewell A	1966	1994	1996	Closes 2006
Oldbury	1968	1995	1998	Closes 2010
Wylfa	1971	1996	2004	Closes 2008
AGR / PWR Installations				
Hinkley Point B	1976	1996	2006	
Hunterston B	1976	1996	2006	
Dungeness B	1982	1997	2007	
Heysham 1	1983	1998	2008	
Hartlepool	1984	1998	2008	
Heysham 2	1989	1999	2009	
Torness	1989	1999	2009	
Sizewell B	1994	2004		

Note: The first safety reviews were called Long Term Safety Reviews and were undertaken at about 25 years of operational life. These were followed by PSRs, which are now undertaken at approximately 10 yearly intervals.

NS.R.2, 10.3: It shall be determined by means of the PSR to what extent the existing safety analysis report remains valid. The PSR shall take into account the actual status of the plant, operating experience, predicted end-of-life state, current analytical methods, applicable safety standards and the state of knowledge.

6.15 Prior to any new nuclear installation being authorised to operate, the licensee must have a valid safety case, which is essentially a written demonstration that the intended operation of the plant will be adequately safe. The safety case therefore confirms that all credible hazards have been identified, appropriate standards have been set and met, adequate safety features are in place, all significant assumptions have been identified, verified and validated, and that all instructions, limits and conditions required to maintain operations within specified margins for safety have been identified.

6.16 As an installation matures, modifications are made to the plant, ageing effects take place, some components may become obsolete and need replacing and plant operating

instructions may be changed as a result of experience. During all this time the safety case must remain valid. The PSR process is designed to ensure that a thorough and comprehensive review is made of the safety case at regular intervals throughout a nuclear power station's life. The reviews have become a well-established feature in the licensing requirements for nuclear plant, and are intended to be more wide ranging than a restatement of the safety case. They complement the normal day-to-day operational monitoring of safety, which is further underpinned by thorough inspections and assessment of the condition of the plant during normal maintenance and testing as well as during the planned periodic reactor shutdowns.

6.17 The objectives of the PSRs are:

- To review the total current safety case for the station and confirm that it is adequate;
- To compare against current standards for new plant, evaluate any deficiencies and implement any reasonably practicable improvements to enhance plant safety;
- To identify any ageing process which may limit the life of the plant; and
- To revalidate the safety case until the next PSR, subject to the outcome of routine monitoring by the licensee and regulation by HSE.

6.18 In reviewing the total current safety case, which is the first objective, the licensee reaffirms the validity of the original safety case, reflecting on factors such as:

- The original safety standards to which the plant was built;
- The various engineering improvements introduced during the operational lifeTime which have enhanced safety; and
- The numerous safety assessments undertaken during the station's life.

6.19 The second objective, to compare against current standards for new plant, is not straightforward. Advances in scientific and engineering knowledge, coupled with experience during operation of all types of plant, generally contribute to improvements in safety standards and practices. In many cases, this will be beneficial to existing plant. For example, advances in scientific knowledge may be used to provide greater confidence in the continued safe operation of a plant. Therefore the review addresses all relevant advances in safety standards and practices. Any significant shortcomings should be identified, and any improvements, which are reasonably practicable, should be introduced.

6.20 Another essential element of the review is for all structures, systems, or components susceptible to ageing or wear-out to be examined, and failure mechanisms, together with any life-limiting features, identified. These various factors then have to be evaluated, particularly for aspects that may eventually result in unacceptably reduced levels of safety, and ultimately dictate the safe working life of the nuclear installation.

6.21 Finally, the PSRs confirm that the safety case will remain valid until the time of the next review, which is normally set at ten years. As stated above, the PSRs complement the normal operational monitoring of safety, which is also regulated by HSE. Therefore, although the PSRs may conclude that the safety case is adequate for another ten years, this will be dependent upon continuing satisfactory results from routine inspections. Should any safety related factor emerge in the interim period that may throw doubt upon the continuing validity of the safety case, this would require the licensee to resolve the matter to HSE’s satisfaction.

NS.R.2, 10.5: In order to complement the deterministic assessment, consideration shall be given to the use of probabilistic safety assessment (PSA) for input to the PSR to provide insight into the relative contributions to safety of different aspects of the plant.

6.22 The PSRs review the analysis of faults that could evolve into accidental sequences (initiating faults) and the defences available at the plant to mitigate the consequences. The analysis includes the two complementary approaches of deterministic and probabilistic assessment. A comprehensive fault schedule, which includes both internal initiating events as well as internal and external hazards, is the starting point of both deterministic and probabilistic safety analyses. The deterministic approach is used in the analysis of design basis accidents (DBAs) to demonstrate the capability of the safety systems. Analyses are also undertaken of more severe faults outside the design basis, which could lead to large releases of radioactivity. This includes: analysis of the potential failures of the physical barriers to the release of radioactivity; analysis of the magnitude and characteristics of the releases; identification of the accident management strategies to reduce the risk, together with the necessary equipment, instrumentation and accident management procedures. Level 2 PSAs were produced as part of the first PSRs (where PSAs did not already exist). Although regulatory decisions are unlikely to be made on the basis of probabilistic analysis alone, the PSA provide an important aid to judging the relative importance of identified potential engineering shortcomings.

6.23 The results of the PSRs have produced, and continue to produce, worthwhile improvements to safety. So far they have revealed no factors seriously prejudicial to the continued operation in the foreseeable future of any operating nuclear installation. The first reviews however, identified many areas where improvements were both necessary and practical. In some cases the licensees chose to close down the plant rather than invest in an upgrading programme. The continuing programme of reviews is however a vital part of HSE's monitoring of an operator's performance, and an essential input to any agreement by the HSE to the continued operation of any nuclear installation.

Article 7 - Legislative and Regulatory Framework

'1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.

2. The legislative and regulatory framework shall provide for:

(i) the establishment of applicable national safety requirements and regulations;

(ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence;

(iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;

(iv) the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.'

7.1 The following describes the UK's nuclear safety legislative and regulatory framework applicable to nuclear installations as defined by the CNS. Its content has been informed by relevant IAEA requirements standards as indicated in the boxes that appear throughout the text

2.(i) National safety requirements and regulations

GS-R-1, 2.2(1): A legislative and statutory framework shall be established to regulate the safety of facilities and activities.

7.2 http://www.dti.gov.uk/energy/nuclear/safety, under the heading of safety, sets out in summary the distribution of responsibility and accountability among Ministers, independent bodies and the devolved administrations including:

- safety regulation at civil nuclear sites;
- nuclear emergency planning and response to a nuclear emergency or incident;
- safe storage, use, discharge and disposal of radioactive materials; and
- involvement in international work on nuclear safety.

7.3 The following legal instruments define the regulation of the safety of nuclear installations in the UK.

The Health and Safety at Work etc. Act 1974 (HSWA74)[6]

7.4 Under the HSWA74, a general duty is placed on all employers (not just nuclear site licensees) to conduct their undertaking in such a way as to ensure, so far as is reasonably practicable, the health and safety at work of their employees and also of persons not in their employment who may be affected by their work activities. This act also defined two regulatory bodies, the Health and Safety Executive (HSE) and the Health and Safety Commission (HSC) (see paragraphs 8.1 to 8.5). Extracts of the HSW Act relevant to the CNS are contained in Annex 3.

7.5 The Nuclear Installations Act 1965 etc. (Repeals and Modifications) Regulations 1974 made HSE the nuclear licensing authority for nuclear sites.

Nuclear Installations Act 1965, as amended (NIA65)[7]

7.6 Under the NIA65 no site can be used for the purpose of installing or operating a nuclear installation unless a nuclear site licence is currently in force, granted by the HSE. Only a corporate body, such as a registered company or a public body, can hold a licence and the licence is not transferable. Sections 1, 3 to 6, 22 and 24A of the NIA65 are relevant statutory provisions of the HSWA74 (i.e. these sections of pre-existing law are subject to HSW Act arrangements for regulation and enforcement). The parts of each of these sections relevant to the CNS are contained in Annex 4.

Ionising Radiations Regulations 1999 (IRR99)[8]

7.7 The nuclear site licensing regime is complemented by the IRR99 that provide for the protection of all workers and members of the public, whether on licensed sites or elsewhere, from ionising radiations. IRR99 implements aspects of the European Council Directive [9] establishing Basic Safety Standards and include the setting of radiation dose limits for employees and members of the public for all activities involving ionising radiation. IRR99 also implements Council Directive 90/641/Euratom [10] on the operational protection of outside workers exposed to the risk of ionising radiation during their activities in controlled areas. Outside workers are persons undertaking activities in radiation controlled areas designated by an employer other than their own. Further information on the application of IRR99 can be found under Article 15.

Electricity Act 1989[11]

7.8 Before building or extending nuclear installations, planning consent under the procedure set out in the Electricity Act 1989 is necessary. Under this Act a generating station with a capacity greater than 50 megawatts requires a consent granted by the Secretary of State for Trade and Industry (for England and Wales) or the Secretary of State for Scotland under section 36 of the Electricity Act 1989 before being constructed, extended or operated. An applicant granted planning consent to use the site will need a licence from HSE to install and operate the nuclear installation.

Radioactive Substances Act 1993 (RSA93)[12]

7.9 The operator of a nuclear licensed site must also meet requirements under the RSA93 for prior authorisation to dispose of radioactive waste. Disposal includes the discharge of radioactive effluent to the environment, incineration of solid or liquid waste, burial of solid waste or waste transfer to another site. Conditions in authorisations control the wastes that may be disposed of and the disposal routes that may be used. The authorisations set limits on the quantities of waste that may be disposed of, place requirements on monitoring and require records to be kept. The Act was amended by the Environment Act 1995 (EA95)[13] to set up the Environment Agency (EA) as the regulatory body for authorisations in respect of premises in England and Wales and the Scottish Environment Protection Agency (SEPA) as the regulatory body for Scotland.

7.10 Legal requirements for the keeping and use of radioactive material and authorisation for the accumulation of radioactive waste are addressed by provisions in the Licence Conditions attached to a nuclear site licence.

The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999[14]

7.11 These regulations implement the requirement for an environmental impact assessment for decommissioning nuclear power stations and nuclear reactors arising from Council Directive 85/337/EEC[15] (as amended by Council Directive 97/11/EC[16] on the assessment of the effects of certain public and private projects on the environment. Before decommissioning or dismantling of a nuclear reactor or power station can take place, a licensee must apply to HSE for consent, undertake an environmental impact assessment and provide an environmental statement. The information to be included in an environmental statement is referred to and specified in Schedule 1 to the regulations.

Utilities Act 2000[17]

7.12 The Utilities Act 2000 applies to the gas and electricity sectors in Great Britain. It established a single Gas and Electricity Markets Authority with the aim of achieving a fair balance between the interests of consumers and shareholders by setting duties and powers for the Authority. It also established an independent Gas and Electricity Consumer Council. Provisions in the Act enable the gas and electricity sectors to make an appropriate contribution to the Government's social and environmental objectives. Other provisions make regulation more transparent and predictable. The Act also updates the financial regulatory regime for the gas and electricity sectors to take account of, and to facilitate further, competition, and to reflect increasing convergence between the two sectors. It provided the powers needed to bring in electricity trading arrangements.

The Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) [18]

7.13 REPPIR implemented in Great Britain the articles on intervention in cases of radiation emergency in European Council Directive 96/29/Euratom[9]. It also partly implements Council Directive 89/618/Euratom [19] on informing the general public about health protection measures to be applied and steps to be taken in the event of an emergency. A radiation emergency is defined as an event that is likely to result in any member of the public receiving an effective dose of 5 mSv during the year immediately following the emergency.

The Management of Health and Safety at Work Regulations 1999 [20]

7.14 These Regulations are relevant as they include requirements on employers, and hence nuclear site licensees, to:

I. make assessments of the health and safety risks of their activities;
II. make, give effect to and record the appropriate health and safety arrangements;
III. ensure that their employees are provided with appropriate health surveillance;
IV. appoint an adequate number of competent persons to assist them in complying with health and safety legislation;
V. establish and give effect to procedures to be followed in the event of serious or imminent danger arising;
VI. provide employees with information concerning the:-
    a) risks to their health and safety;
    b) preventive and protective measures;
    c) procedures necessary in the event of serious or imminent danger; and
    d) persons nominated to implement evacuation procedures;
VII. co-operate with other employers to enable statutory health and safety obligations to be met, including the provision of health and safety information; and
VIII. ensure that employees, taking into account their capabilities, have adequate health and safety training which is repeated periodically as appropriate.

7.15 The Regulations are of a wide ranging nature. Where the requirements overlap with other Health and Safety Regulations, compliance with the more specific Regulations is normally sufficient for compliance with the Management of Health and Safety at Work Regulations.

2.(ii) The system of licensing nuclear installations

GS-R-1, 2.2(2): A regulatory body shall be established and maintained, which shall be effectively independent of organisations and bodies charged with the promotion of nuclear technologies or responsibility for facilities or activities.
GS-R-1, 2.2(3): Responsibility shall be assigned to the regulatory body for authorisation …
GS-R-1, 2.2(5): No other responsibility shall be assigned to the regulatory body which may jeopardise, or conflict with, its responsibility for regulating safety.

7.16 The Nuclear Installations Act 1965 etc. (Repeals and Modifications) Regulations 1974[21] made HSE the nuclear licensing authority for nuclear sites. As a result, under the NIA65 no site can be used for the purpose of installing or operating a nuclear installation unless a nuclear site licence is currently in force, granted by the HSE. The authority to grant a nuclear site licence is delegated to Her Magesty's Chief Inspector of Nuclear Installations, who is also the Director of HSE's Nuclear Safety Directorate (NSD), which administers this licensing function on HSE's behalf.

7.17 RSA93 as amended by EA95 makes the EA the regulatory body for authorisations for the disposal of radioactive waste in respect of nuclear licensed sites in England and Wales and SEPA the regulatory body for Scotland. As part of the implementation of the Basic Safety Standards Directive 96/29/Euratom a number of the Environment Agencies' existing administrative practices under RSA93 were made legally binding obligations.

7.18 HSE's independence as a regulator is ensured under HSWA74, where HSE is given direct responsibility for the enforcement of the nuclear safety regulatory system. Similarly, the environment agencies are made responsible to provide the environmental protection regulatory system under RSA93.

7.19 There are also governmental mechanisms in place to maintain the regulatory independence. HSE is sponsored by the Department for Work and Pensions (DWP), which has no role in promoting nuclear technology or responsibilities for facilities or activities. However, the Secretary of State for Trade and Industry is answerable to Parliament for nuclear safety in Great Britain. In this respect HSE can provide factual information to this Minister on matters of nuclear safety regulation, but this Minister is not responsible for HSE's nuclear regulatory actions. In addition, HSE maintains good lines of communication with the Department of the Environment, Food and Rural Affairs (Defra), notably the Radioactive Substances Division, to ensure that the nuclear safety implications of environmental policy and vice versa are properly considered. Defra again has no role in promoting nuclear technology or responsibilities for facilities or activities.

7.20 EA is sponsored by Defra and the Welsh Assembly Government (WAG). On radioactive waste matters it works closely with the Radioactive Substances Division of Defra, the Department of Health (DoH) and the WAG. It also maintains good lines of communication with DTI.

7.21 SEPA is sponsored by the Scottish Executive. On radioactive waste matters it works closely with the Scottish Executive Environment and Rural Affairs Department, the

Radioactive Substances Division of Defra and the DoH. It also maintains good lines of communication with DTI.

7.22 The DTI has a number of policy roles in respect of the nuclear industry. These include responsibility for energy policy generally (including the role of nuclear power), prescribing the activities that should be subject to the nuclear licensing regime, nuclear emergency planning, nuclear security and safeguards, international treaties and the Convention on Nuclear Safety, and the international nuclear liability regime. It is also responsible for those parts of the UK civil nuclear industry still owned by the Government (this includes BNFL).

7.23 In carrying out its responsibilities, DTI will, when appropriate, seek technical factual information on safety related matters from HSE and advice on environmental issues fron the environment agencies through Defra.

7.24 Concordats or Memorandums of Understanding (MOUs) exist between the regulators and the Food Standards Agency. In addition, the Food Standards Agency acts as statutory consultee to both EA and SEPA under RSA93. Regular liaison meetings take place between EA and SEPA and Food Standards Agency.

2.(iii) and 2.(iv) The legislative and regulatory framework for inspection and assessment of compliance and enforcement

GS-R-1, 2.2(4): The regulatory body shall be provided with adequate authority and power … to discharge its assigned responsibilities.

7.25 The HSWA74 enables HSE to appoint inspectors and give them regulatory powers (see Article 8) of assessment and inspection. Extracts of the HSWA74 relevant to the CNS are contained in Annex 3.

7.26 The HSE's Nuclear Safety Directorate (NSD) is one of HSE's operational Directorates. Her Majesty's Nuclear Installations Inspectorate (NII) is that part of NSD to which the day to day exercise of the Executive's nuclear licensing function is delegated. In particular, the Executive has delegated to the HM Chief Inspector of Nuclear Installations the authority to carry out on its behalf certain functions under the HSWA74 and NIA65. Thus the Chief Inspector has the powers to grant or vary Nuclear Site Licences, to attach, vary or revoke Conditions of the Licence. Deputy Chief Inspectors have the powers to Direct the shutdown of operations or issue Consents to allow reactors to commence operation after statutory shutdowns. Annex 2 lists HSE's powers under a Nuclear Site Licence.

GS-R-1, 2.2(4): The regulatory body shall be provided with adequate … staffing to discharge its responsibilities

7.27 HSE controls the bubget for the recruitment of nuclear installations inspectors. HM Chief Inspector of Nuclear Installations bids for resources from HSE based on reviews of staffing requirements in the forseeable future. After this process HSE appoints suitably qualified and experienced inspectors under Section 19 of the HSWA74 see Annex 3. Inspectors have letters of authorisation specifying the powers conferred on them under:

- (i) sections 20, 21, 22, 25 and, in England and Wales, 39 of the HSWA74 (see Annex 3);
- (ii) any health and safety regulation; and
- (iii) the provisions of the Acts mentioned in Schedule 1 to the HSWA74.

GS-R-1, 2.2(4): The regulatory body shall be provided with adequate … financial resources to discharge its assigned responsibilities.

7.28 Section 24A of the NIA65 enables HSE to impose a financial charge on the nuclear licensees to recover the expenses incurred through its regulation of nuclear installations. In addition further expenses are recovered from the largest licensees in respect of a programme of generic safety research agreed between HSE and the industry. HSE uses a work recording system to identify the effort and expenses of its staff attributable to each licensee.

7.29 Section 41 of the Environment Act 1995 provides EA and SEPA with the power to impose financial charges for regulatory activities in order to recover the expenses incurred through regulation. Such expenses include those incurred in respect of a programme of waste and environmental monitoring carried out by EA and SEPA. EA and SEPA use a work recording system to identify the effort and expenses of its staff attributable to each licensee.

GS-R-1, 2.2(8): An effective system of governmental emergency response and intervention capabilities shall be established and emergency preparedness shall be ensured.

7.30 REPPIR implemement in Great Britain the articles on intervention in cases of radiation (radiological) emergency in Council Directive 96/29/Euratom. REPPIR also partly implement Council Directive 89/618/Euratom (known as the Public Information Directive) on informing the general public about health protection measures to be applied and steps to be taken in the event of an emergency. REPPIR places on a statutory basis the arrangements whereby a local authority with a nuclear site or sites in its area prepares an off-site emergency plan. Licensees will also have to comply with additional requirements on the public availability of certain information. Further informaton on emergency preparedness can be found under Article 16. (IRR99 also require the preparation of contingency plans under Regulation 12.)

7.31 A condition attached to a nuclear site licence, LC 11 (see Annex 5), on emergency arrangements, ensures that the licensee has adequate arrangements in place to respond

effectively to any incident ranging from a minor on-site event to a significant release of radioactive material. The Condition requires employees to be properly trained and that the emergency arrangements are exercised. There is also a requirement for the licensee to consult with any person not in their employ who may be required to participate in emergency arrangements. The licensee must submit to HSE for approval such parts of the arrangements as HSE may specify. Once approved by HSE no alteration or amendment can be made to the approved arrangements unless HSE has approved the alteration or amendment. LC 11 requires the arrangements to be rehearsed to ensure their effectiveness.

7.32 The DTI also has an ongoing lead department role in bringing together organisations involved in off-site nuclear emergency planning through the Nuclear Emergency Planning Liaison Group (NEPLG). Members include representatives of the nuclear operators, the police, fire service, local authority emergency planning officers and government departments and agencies that would be involved in the response to an emergency. The NEPLG provides a forum for discussing common problems, exchanging information and experience and agreeing improvements in planning, procedures and organisation. The NEPLG has issued a number of guidance documents aimed at all those involved in the development of site-specific emergency plans at local level [22].

7.33 See also Article 16

GS-R-1, 2.2(11): The technological infrastructure necessary for ensuring the safety of facilities and activities shall be provided, where this is not provided by other organisations.

7.34 The nuclear safety research and development programme is undertaken to ensure the continued safe operation of facilities and activities on nuclear licenced sites in the UK and operates within the legislative framework of HSWA74. This Act places a duty on HSE to make arrangements for carrying out research to support its statutory role as the health and safety regulator and advisor, and also to encourage research by others. The NIA65 gives the HSE, at the direction of the HSC, the further power to recover from the nuclear licensees any expenses incurred if it should consider it necessary to commission research into nuclear safety in support of its regulatory activities. The Atomic Energy Act 1989 transferred the responsibility to direct the UK's Generic Nuclear Safety Research Programme to the HSC and where necessary to recover the costs of this programme, which is managed by HSE on behalf of the HSC. Most of the safety research in this programme is funded and either undertaken or managed by the licensees themselves. Research proposals and the results of any research projects undertaken as part of this generic safety programme are shared with HSE. Also, HSE uses its powers to commission research of its own and recover its costs, where UK participation in international collaborative research is more appropriately carried out through a government agency (such as participation in OECD-NEA projects and the Euratom framework programmes), or where HSE identifies a need to fund research to maintain its access to independent technical capability to support its regulatory responsibilities, or where a licensee declines to undertake research that the HSE has judged to be important for nuclear safety.

7.35 HSWA74, section 13(1)(f), gives HSC the power to carry out or arrange for or make payments in respect of research into any matter connected with any of HSC's functions, and to disseminate … information derived from such research.

GS-R-1 2.4(7): The legistlation shall establish a procedure for review of, and appeal against, regulatory decisions (without compromising safety).

7.36 HSE adopts a tiered approach to appeals against regulatory decisions made by nuclear licensees. If the licensees fail to get satisfaction from the Chief Inspector, they may formally appeal to the Executive, which is a legal entity. The Executive has a formal appeals procedure, where it can take evidence from the Nuclear Installations Inspectorate and the licensee. Their decision is final.

7.37 The process of Judicial Review is always open within UK law to challenge regulatory decisions but this only applies to a review of process.

7.38 In relation to the construction of new installations, applicants who are refused planning permission by a local planning authority, or who are granted permission subject to conditions that they find unacceptable, or who do not have their applications determined within the appropriate period, may appeal to the Secretary of State. Appeals are sent to the Planning Inspectorate (PINS), which is an executive agency of the Office of the Deputy Prime Minister and the Welsh Office.

GS-R-1 2.4(8): The legislation shall provide for continuity of responsibility when activities are carried out by several operators successively and for recording of the transfers of responsibility.

7.39 Under NIA65 the Nuclear Installation licensing system applies throughout the lifetime of a civil nuclear site including installation, commissioning and operation to eventual decommissioning. The NIA65 and HSWA74 allow the HSE to revoke a licence or for it to be surrendered by the licensee. However, in either event, the licensee will remain responsible for the safety of activities on the site. This "period of responsibility" can end only when a new licence has been granted for the site or the HSE has given written notice that in its opinion there has ceased to be any danger from ionising radiations from anything on the site.

GS-R-1 2.4(9): The legislation shall allow for the creation of independent advisory bodies to provide expert opinion to, and for consultation by, the government and regulatory body.

7.40 Section 13(1)(d) of HSWA74 allows HSC to appoint committees to provide the HSC with advice on any of its functions. Hence, the HSC is able to draw on independent expert technical advice on nuclear safety issues from an independent committee: the Nuclear Safety Advisory Committee (NuSAC). NuSAC comprises experts from industry, academia and elsewhere. It provides a technical forum in which nuclear safety issues, and any proposals that might impact on nuclear safety, can be considered in an open and independent a manner as possible. Its terms of reference are:

- 'To advise the HSC on matters which are referred to it or which it considers require attention regarding nuclear safety policy and its implementation at nuclear installations; and

- To advise the HSC on the adequacy and balance of HSC's nuclear safety research programme.'

7.41 HSC has established the Ionising Radiations Health & Safety Forum (IRHSF) to consider all matters concerning protection against ionising radiations that are relevant to HSC's remit. IRHSF consists of a wide cross-section of organisations including representatives from industry and the unions, local authorities, government departments and professional bodies. Its work includes consideration of the standards of protection for workers and others from work activities involving ionising radiations, monitoring the effectiveness of legislation and monitoring developments in technology.

GS-R-1 2.4(10): The legislation shall set up a means whereby research and development work is undertaken in important areas of safety.

7.42 HSWA74, section 13(1)(f) provides the HSC with the power to carry out, or arrange for, or make payments in respect of, research into any matter connected with any of HSC's functions.

GS-R-1 2.4(13): The legislation shall set out the responsibilities and obligations in respect of financial provision for radioactive waste management and decommissioning.

7.43 In November 2001, the Government announced changes to arrangements for the clean up of Britain's nuclear legacy. A White Paper, "Managing the Nuclear Legacy – a strategy for action", was published in July 2002. It set out the Government's proposals, including the establishment of a new public body, the Nuclear Decommissioning Authority (NDA). This body will provide the strategic direction for cleaning up Britain's civil public sector nuclear sites. The Government set out its detailed proposals for the NDA in an Energy Bill published on 28 November 2003. The progress of this Bill through its Parliamentary processes and further information on this topic can be found at:
http://www.dti.gov.uk/nuclearcleanup.

7.44 The Nuclear Decommissioning Agreement provides for a fund run by trustees to meet all the costs of decommissioning British Energy's (BE) nuclear licensed sites. The fund receives predetermined contributions from BEG(UK)L and BEGL , which are reassessed quinquennially to ensure that there are adequate assets to meet the liabilities. The arrangements were set out in full in the British Energy Share Prospectus:

- "Nuclear Generation Decommissioning Fund Limited was incorporated on 28 March 1996 for the purpose of providing arrangements for funding certain long term costs of decommissioning British Energy's power stations. It is owned by the trustees of an independent trust ("The Nuclear Trust"). Three of the trustees are appointed by HM Government and two appointed by British Energy. The ratio of independent directors of the fund company to those appointed by British Energy is the same. "

- "In the Nuclear Review, HM Government concluded that segregated funds were the best way of ensuring public confidence that Nuclear Electric and Scottish Nuclear would meet their decommissioning obligations and that the costs of meeting these long term nuclear liabilities did not fall to taxpayers by default. In connection with

the privatisation of British Energy, arrangements have been made for a segregated fund. The structure and scope of the fund have been agreed by the NII [HSE], which is also satisfied that the arrangements are sufficiently flexible to accommodate changes to the companies' decommissioning strategies."

7.45 Financial details of the BNFL dedicated liabilities fund are set out in the annual accounts. The British Energy report includes contributions in the financial year; the basis for the contributions was in the BE Share Prospectus.

GS-R-1 2.4(14): The legislation shall define what is an offence and the corresponding penalties.

7.46 Provisions as to offences are specified in HSWA74 sections 33 to 42. Penalties are defined in section 33 of the Act. The maximum penalty depends on the nature of the offence and whether the case is tried in the Magistrates Court or Crown Court. The maximum penalty in the Magistrates Court is a fine of £20,000 and/or a prison sentence of six months. The maximum penalty in the Crown Court is an unlimited fine and/or a prison sentence of two years.

GS-R-1 2.4(15): The legislation shall establish implement any obligations under international treaties, conventions or agreements.

7.47 The IRR99 made under the HSWA74, implemented most of the revised Basic Safety Standards Directive (96/29/Euratom). IRR99 also implement Council Directive 90/641/Euratom of 4 December 1990 on the operational protection of outside workers exposed to the risk of ionising radiation during their activities in controlled areas.

7.48 REPPIR implemement in Great Britain the articles on intervention in cases of radiation emergency in Council Directive 96/29/Euratom. REPPIR also partly implement Council Directive 89/618/Euratom (known as the Public Information Directive on informing the general public about health protection measures to be applied and steps to be taken in the event of an emergency. RSA93 was amended by the EA95 so that the EA is the regulatory body for authorisations in respect of premises in England and Wales and the SEPA is the regulatory body for Scotland. As part of the implementation of the Basic Safety Standards Directive 96/29/Euratom a number of the Agencies' existing administrative practices under RSA93 have been put into legally binding obligations.

7.49 The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 implement the requirement for an environmental impact assessment for decommissioning nuclear power stations and nuclear reactors arising from Council Directive 85/337/EEC (as amended by Council Directive 97/11/EC) on the assessment of the effects of certain public and private projects on the environment.

GS-R-1 2.4(16): The legislation shall define how the public and other bodies are involved in the regulatory process.

7.50 Planning permission is obtained from the relevant local authority under the Town and Country Planning Act 1990 (TCP Act) for England and Wales or the Town and Country Planning (Scotland) Act 1997 for Scotland. In some instances, an application for planning

permission may be "called in" by the relevant Minister for ministerial decision. This usually reflects the fact that the development is seen as having national importance. The planning authority may suggest the "call in". Where an application for planning permission is "called in", a local Public Inquiry is set up. In England and Wales the independent Planning Inspectorate arranges for one of its inspectors to hear and receive evidence for or against the proposal. The inspector then makes a report and a recommendation to the Office of the Deputy Prime Minister for England or the Welsh Assembly Government. In Scotland, the Scottish Executive Inquiries Reporter usually reviews written evidence and issues a decision letter. Some cases are considered by means of a Public Inquiry, with the decision taken by the Scottish Ministers. This decision is made public by letter issued by the staff of the Planning Division of the Scottish Executive Development Department.

7.51 The planning application process provides an opportunity to inform and obtain views from the public. For major developments such as a radioactive waste repository, this would be through the public inquiry process. Similarly, the environment agencies will consult on a developer's application for the authorisation of disposal of radioactive waste in a repository. HSE, EA and SEPA have corporate policies to ensure that public information is available in an open and transparent manner subject to the requirements of the Freedom of Information Act and the Freedom of Information (Scotland) Act, 2002.

7.52 One of the statutory objectives of the Environment Agencies is to develop a close and responsive relationship with the public, local authorities and other representatives of local communities and regulated organisations. In determining applications for radioactive waste disposals on or from sites licensed under NIA65, the agencies consult statutory bodies such as local and health authorities, fisheries and agriculture committees, in addition to the Food Standards Agency and the HSE. They also undertake wide public consultation. After considering all the views expressed, they publish a "decision document" setting out the factors they have taken into account in reaching their decision. In Scotland, SEPA also consults with the Scottish Executive for applications made to dispose of radioactive waste from nuclear licensed sites under the terms of a mutual agreement.

GS-R-1 2.4(17): The legislation shall specify the nature and extent of the application of newly established requirements to existing facilities and current activities.

7.53 Modifications to either the design intent of a new plant or the upgrading of facilities in an old plant represent a change that affects the validity of the existing safety case. Consideration of such changes is an essential element in the justification of the proposed modification, and is controlled by the licence conditions. In such situations, the licensee has to update the safety case to the satisfaction of HSE before any change significant to safety is made. More information on the licence conditions and their coverage is given under other Articles, particularly Article 6, and Annex 5.

ARTICLE 8. REGULATORY BODY

1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.

2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.

ORGANIZATION OF THE REGULATORY BODY

GS-R-1. 4.1: The Regulatory Body shall be structured so as to ensure that it is capable of discharging its responsibilities and fulfilling its functions effectively and efficiently.

8.1 The legal framework of the regulatory body was introduced under Article 7. Further details of the regulatory structure and operation are provided below and at Annex 6.

Health and Safety Commission (HSC)

GS-R-1 3.1: The Regulatory Body shall define policies … as a basis for its [nuclear safety] regulatory actions.

8.2 HSC was set up by HSWA74 as the overarching body that sets the policy framework for health and safety regulation. The HSC's duties include:

a) assist and encourage people to promote health and safety at work;

b) make arrangements to carry out and publish research and provide training and information in connection with health and safety at work;

c) ensure that people are kept informed of, and adequately advised on, matters relevant to health and safety at work; and

d) submit proposals for the making of regulations.

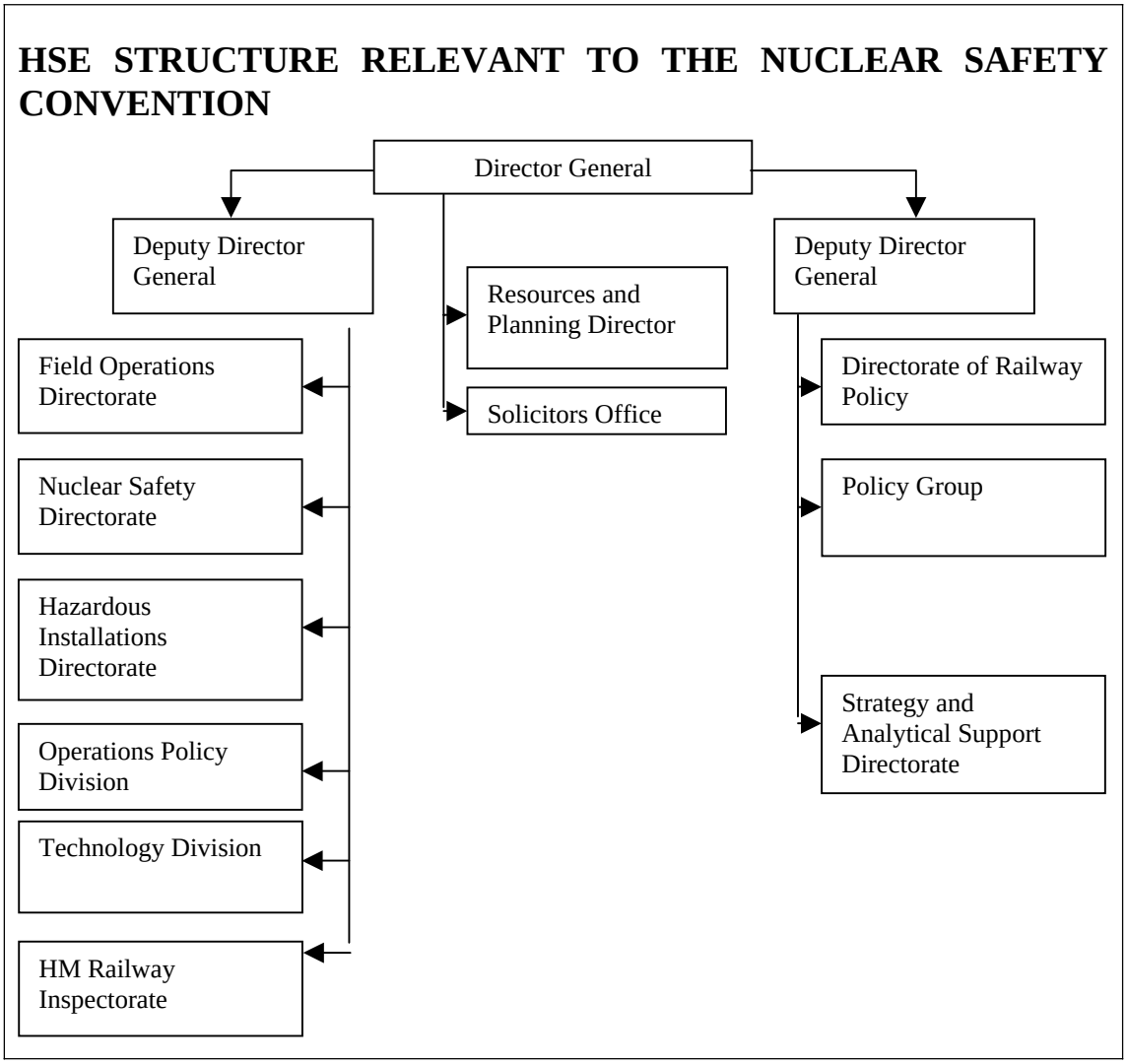
8.3 The HSC provides general policy direction for HSE's nuclear activities. HSE converts this policy into strategic initiatives.

Health and Safety Executive

8.4 The Health and Safety Executive (the 'Executive') is the second body set up by HSWA74 and comprises three persons appointed by HSC with the approval of the Secretary of State. The Executive's duty is to enforce the relevant statutory provisions where it is the

enforcing authority; to exercise on behalf of the HSC such of the HSC's functions as HSC directs; and to give effect to any directions given to it by HSC (except that HSC cannot give the Executive any directions as to enforcement in a particular case). HSWA74 empowers the Executive to employ civil servants to assist it, who are known collectively as the HSE. In particular the Executive appoints inspectors, to allow it to carry out its duties. Inspectors have a range of powers including powers of entry, powers to investigate and, in England and Wales, to prosecute. HSE's structure relevant to the CNS is shown in Figure 8.1 below.

Figure 8.1



8.5 HSE is responsible for enforcing legislation on health and safety at work and in particular, in relation to nuclear installations, for the operation of the nuclear site licensing regime. Within HSE, the responsibility for regulating the nuclear industry has been delegated to its Nuclear Safety Directorate (NSD), NSD includes HM Nuclear Installations Inspectorate (NII) and it is NII that carries out the licensing and day-to-day regulation of the nuclear industry. Licensing powers are delegated to HSE's Director of Nuclear Safety, who is also Her Majesty's Chief Inspector of Nuclear Installations. This delegated authority from the Executive gives the Chief Inspector the power to issue, add conditions to, and revoke nuclear site licences.

Environment Agency and Scottish Environment Protection Agency

8.6 The EA is the principal environmental regulator in England and Wales. SEPA has the equivalent responsibilities in Scotland. Their regulatory responsibilities include the authorisation of the disposal of radioactive wastes from nuclear licensed sites. There are no nuclear installations in Northern Ireland.

Responsibilities of other Agencies and bodies

8.7 The National Radiological Protection Board (NRPB) was created by the Radiological Protection Act 1970. The statutory functions of NRPB are:

a) by means of research and otherwise, to advance the acquisition of knowledge about the protection of mankind from radiation hazards; and

b) to provide information and advice to persons (including Government Departments) with responsibilities in the United Kingdom in relation to the protection from radiation hazards either of the community as a whole or of particular sections of the community.

8.8 NRPB also:

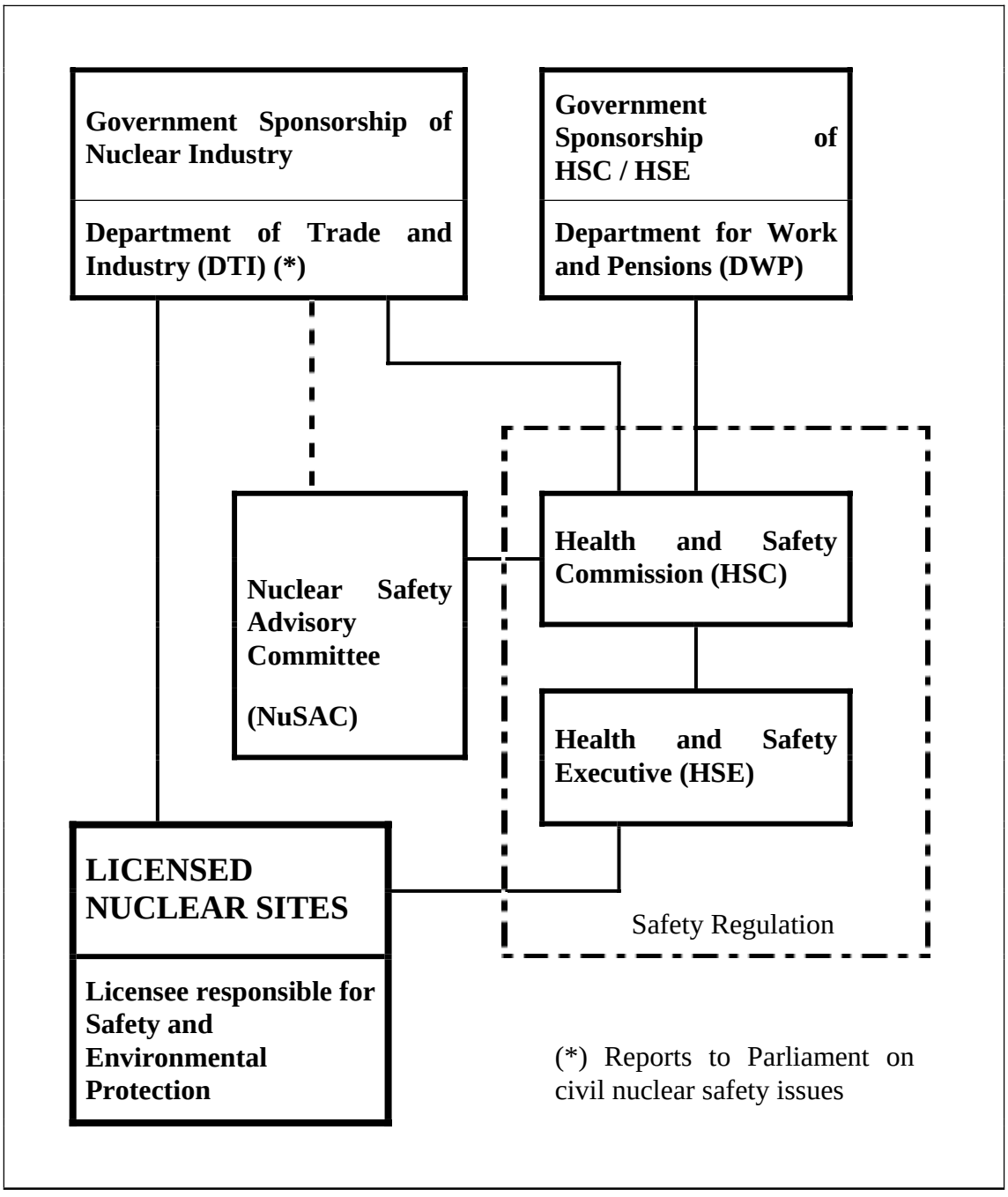
c) provides technical services to persons concerned with radiation hazards; and

d) makes charges for such services, and for providing information and advice.

8.9 Further information on the Nuclear Installations' regulators is at Annex 6, which includes: mandates and duties; structure; and resources.

8.10 Figure 8.2 illustrates the responsibilities of the various bodies relevant to nuclear safety in the UK and how they interact.

Figure (8.2) Responsibilities for Nuclear Safety at nuclear installations (licensed sites)



GS-R-1. 4.1: The regulatory body shall have an organisational structure and size commensurate with the extent and nature of facilities and activities it must regulate.

8.11 HSE normally reassesses the resources it needs to regulate the nuclear industry about every five years taking account of potential changes in the nuclear industry over the following 20 years. In doing so, it builds on earlier horizon scanning exercises and on strategic reviews of the most probable scenario for the industry using current information. The assessment provides a detailed analysis of nuclear regulation and resource projections, which not only considers the work arising from the changing nature of the nuclear industry, but also considers its own structure including its retirement profile and a practical recruitment rate. The most recent analysis showed projected recruitment needs were insensitive to a detailed understanding of the workload scenario beyond five years, as any work reduction due to changing circumstances could be matched by retirements or alternatively there would be time to adjust recruitment requirements.

8.12 HSE's NSD also prepared a Strategic Plan for 2003 –2006 [25], which set down goals for that period.

8.13 The resource profiles were compiled against current predictions of regulatory activities including statutory responsibilities to administer nuclear licensing, existing government policy, known licensees requirements (such as the closure plan for reactors), reorganisation of parts of the nuclear industry and nuclear site restoration programmes. HSE's cardre for nuclear installation inspectors is at present 179, with 166 in post. Recruitment campaigns are in progress to make up the difference.

GS-R-1. 4.1: The Regulatory Body's reporting line in the governmental infrastructure shall ensure effective independence from organisations or bodies charged with the promotion of nuclear or radiation related technologies, or those responsible for facilities or activities.

8.14 The governmental infrastructure has been described under Article 7. In particular, under the HSWA74, HSE's independence as regulator of nuclear safety is ensured as HSE is given direct responsibility for the enforcement of the nuclear safety regulatory system. The potential conflict of interest between the roles of the nuclear safety regulator and the financial regulator has been addressed. The Gas and Electricity Markets Authority (GEMA) is the commercial regulatory body for the gas and electricity supply industries in England, Wales and Scotland. Its principal duty is to protect the interests of consumers of gas and electricity wherever appropriate by promoting competition in the shipping, transportation or supply of gas and the generation, transmission, distribution or supply or electricity. GEMA has a duty to consult HSC on '… all electricity safety issues …' and to take account of the advice offered whether or not in response to such consultation. An 'electricity safety issue' is '…. Anything concerning the generation, transmission, distribution or supply of electricity which may affect the health and safety of members of the public, or persons employed in connection with any of those activities'. In addition, a Memorandum of Understanding (MoU) has been drawn up between GEMA and HSE to provide a mechanism for consultation between the two parties where there is, or could be, an overlap of interests and particularly to ensure nuclear safety.

GS-R-1.4.2: If the Regulatory Body consists of more than one authority, effective arrangements shall be made to ensure that regulatory responsibilities and functions are clearly defined and coordinated, in order to avoid any omissions or unnecessary duplication and to prevent conflicting requirements being placed on the operator.

8.15 HSE, the EA and SEPA work closely with one another to ensure the effective co-ordination of their respective regulatory activities at nuclear installations. They have agreed MoUs whose objective is to facilitate the minimisation of the overall detriment due to radioactive waste management on licensed sites, from generation to disposal. Under the NIA65, HSE consults the EA or SEPA before:

- granting a nuclear site licence; or
- varying a nuclear site licence if the variation relates to or affects the creation, accumulation or disposal of radioactive waste.

8.16 Similarly the EA or SEPA consult HSE under the RSA93 [12] on proposed authorisations for disposals of radioactive waste including discharges to the environment.

8.17 In addition to their own routine inspection activities on nuclear licensed sites, the EA and SEPA carry out planned joint inspections with HSE and co-operate in investigations of incidents where appropriate.

GS-R-1.4.2: The [regulatory body's] main functions of review and assessment and inspection and enforcement shall be organised in such a way as to ensure consistency and to enable the necessary feedback and exchange of information.

8.18 HSE's NSD has developed a Business Management System (BMS) to provide an integrated approach to system management, thereby ensuring that the system adds value to internal processes, and reflects the interests of NSD's staff. It has been designed to document appropriate policies, management controls and process controls in a manner that augments the experience, training and professional judgment of all staff. This is reflected in the systems Key Business Activity areas. The system is a living one, as a result experience of its use is gathered and fed back to improve systems if shortfalls are found.

GS-R-1.4.5: The Regulatory Body shall establish and implement appropriate arrangements for a systematic approach to quality management, which extend throughout the range of responsibilities and functions undertaken.

8.19 Within the BMS, procedures and guides of NSD's key processes (Key Business Activities) are documented in a consistent manner. The activity-based approach ensures that the documentation adapts easily to accommodate re-organisations or changes in organisational focus. The system includes a means for continuous improvement. Audit, review and use of specified monitoring tools (e.g. the European Foundation for Quality Management Excellence Model), ensures that the focus on processes maximises the efficiency and effectiveness of efforts towards meeting NSD's aspirations.

GS-R-1 3.1: The Regulatory Body shall define … safety principles and associated criteria as a basis for its [nuclear safety] regulatory actions.
GS-R-1 3.2(1): The regulatory body shall establish, promote or adopt regulations and guides upon which its regulatory actions are based.

8.20 The regulatory approach to nuclear safety in the UK is based on a nuclear site licencing regime (see Appendix 5). Hence, most of the requirements for nuclear safety are made via Conditions attached to the nuclear site licence. As a result the HSE does not specifically address nuclear safety in terms of regulations. However, some issues arising from EC and Euratom Directives have been addressed by the implementing UK regulations (see Article 7).

8.21 Where regulations are appropriate the process of preparing them is as follows:

- A timetable for the preparation of the regulations is agreed with departmental lawyers;
- Instructions are prepared and agreed with the lawyers;
- Draft regulations are prepared and consulted on;
- Final draft regulations are developed taking account of consultation results.
- HSC (if they have responsibility for proposing the regulations), after consideration, approves the draft; and
- Draft regulations and an explanatory memorandum are prepared for relevant Minister to approve the Regulations be "made" (i.e. they are signed by the Minister).

8.22 The Regulations come into force at least 21 days after they are laid before Parliament. This is a complex process but in simple terms the process allows for the following:

- Scrutiny by Parliamentary Committees as to the merits and the drafting accuracy of the regulations.
- Most regulations are subject to the 'negative resolution' procedure, i.e. once the Regulations have been laid before Parliament, any member of each House of Parliament has 40 days from the laying date to object to the Regulations. If this results in a Parliamentary resolution to annul them and it is voted for in Parliament the regulations cease to have effect. Some regulations are subject to the 'positive resolution' procedure, which means that they must be raised first before Parliament.

8.23 HSE has prepared Safety Assessment Principles (SAPs) [26], which form a framework that is used by its Inspectors as a reference for technical judgments on the adequacy of licensees' safety cases. SAPs also assist HSE in applying a consistent and uniform approach to its assessment process. In carrying out an assessment, the HSE nuclear inspectors judge the extent to which the safety submission shows that the design of the plant is in conformity with the relevant SAPs, noting that not all of the principles are applicable to every licensed site. Some of the SAPs embody specific statutory limits. Apart from these, the SAPs should be met, so far as is reasonably practicable, which is a requirement of the HSWA74. There can, therefore, only be a rigid interpretation of the principles that reflect statutory limits.

8.24 The SAPs are aimed primarily at the safety assessment of proposed (new) nuclear plants, but they are also used in assessing the safety of existing plants. 'Back filling' to meet

the SAPs is dependent on the test of reasonable practicability.

8.25 For the assessment of existing plants, there is a further point to be considered: the safety standards used in their design and construction may differ from those used in plants designed and built more recently. The existence of such differences is recognised by HSE when applying the SAPs in the assessment of modifications to old plants. The ALARP principle is of particular importance to such assessments, as are the age of the nuclear installation and its projected life when making regulatory judgments on the reasonable practicability of making improvements.

8.26 To judge the adequacy of the safety case HSE uses both quantitative comparisons of the safety case numerical elements against criteria, and non-quantitative judgment. PSA is part of a methodical accident analysis process that produces numerical estimates of the risk from the plant. It provides a comprehensive logical analysis of the potential for things to go wrong on the plant and the role played by the safety provisions. PSA enables weaknesses in the design to be identified, anticipated and remedied at an early stage. In addition, it can be used to reconcile the calculated risks against the licensee's criteria and against the relevant SAPs. It provides evidence that confirms the plant is balanced, that is, that no particular class of accident or feature of the plant makes a disproportionate contribution to the overall risk.

8.27 The majority of the SAPs are engineering (or deterministic) principles. In creating a design there are many choices to be made. Each choice involves to a greater or lesser extent the use of judgment in technical, scientific or commercial issues. Not all of these judgments are concerned directly with safety, but most will influence its achievement. The deterministic SAPs provide inspectors with guidance on what to look for when judging the ALARP arguments in a safety case. They represent HSE's view of good nuclear engineering practice and point to the provisions that in HSE's view would lead to a safe plant. PSA acts as a crosscheck on the level of safety provision, so that the PSA and deterministic SAPs are complementary.

8.28 HSE has prepared Technical Assessment Guides (TAGs), which are primarily guidance for its inspectors on the interpretation and application of the SAPs. There is also guidance relevant to principles underlining the enforcement of licence condition compliance, which supplements Technical Inspection Guides. The TAGs provide guidance in particular technical areas, and they are used at the discretion of inspectors.

8.29 It is approximately 10 years since the SAPs and other internal guidance like TAGs was last revised and HSE is currently undertaking a review of these documents by benchmarking them against relevant IAEA nuclear safety standards to identify potential gaps and shortfalls. This work is due to be competed by the end of 2005.

ADVISORY BODIES TO THE REGULATORY BODY

GS-R-1. 4.9: The Government or the regulatory body may choose to give formal structure to the processes by which expert opinion and advice are provided to the regulatory body … such bodies shall give independent advice.

8.30 HSC's Nuclear Safety Advisory Committee (NuSAC) and its terms of reference were introduced at paragraph 7.39.

8.31 The Chairman and the 20 members of NuSAC are appointed by the HSC, normally for a period of three years, and are drawn from a wide field of specialisms and expertise. They include four representatives from industry and four representatives from the unions. It discharges its responsibilities mainly through formal meetings of the whole committee and through sub-committees that report to the main Committee on particular subjects. On certain topics NuSAC calls upon HSE and the nuclear licensees to give it appropriate information and considered opinions.

GS-R-1. 4.9: Any advice offered [by the advisory body] shall not relieve the regulatory body of its responsibilities for making decisions and recommendations.

8.32 The HSWA74 makes it clear in law that the advisors can only advise and HSE as the regulator is responsible for the regulatory decisions and recommendations. NuSAC advises the HSC and it is therefore not responsible for commenting upon specific regulatory decisions.

INTERNATIONAL CO-OPERATION

GS-R-1.4.11: National authorities, with the assistance of the regulatory body, as appropriate, shall establish arrangements for the exchange of safety related information, bi-laterally or regionally, with neighbouring States and other interested States, and with relevant intergovernmental organizations both to fulfill safety obligations and to promote cooperation.

8.33 HSE has a number of bi-lateral arrangements with regulatory bodies in other countries to ensure the smooth flow of information relevant to nuclear safety. In addition, HSE's nuclear installations inspectors attend and contribute to international discussions and initiatives on nuclear safety. This includes working with the International Atomic Energy Agency (IAEA) and the Organisation for Economic Co-operation and Development's Nuclear Energy Agency (OECD's NEA), Western Nuclear Regulators Association and the International Nuclear Regulators Association.

GS-R-1 3.3(9): The Regulatory Body shall ensure that its regulatory principles and criteria are adequate and valid, and shall take into consideration internationally endorsed standards and recommendations.

8.34 Representatives of HSE attend and contribute to international discussions and initiatives on nuclear safety standards and recommendations. This includes working with the

IAEA, the Organisation for Economic Co-operation and Development's Nuclear Energy Agency (OECD's NEA), the EU and regulators associations.

8.35 HSE is also currently undertaking a review of its Safety Assessment Principles (SAPs) and Technical Assessment Guides (TAGs) by benchmarking against IAEA Standards, and will address any gaps and shortfalls found in this process with internal and external consultation as necessary. This work is due to be completed by November 2005.

ARTICLE 9 - RESPONSIBILITY OF THE LICENCE HOLDER

'Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.'

GS-R-1 2.3: The prime responsibility for safety shall be assigned to the operator [licensee]. The operator shall have the responsibility for ensuring safety in the siting, design, construction, commissioning, [and] operation.

9.1 The HSWA74 requires every employer so far as is reasonably practicable to:

i) ensure the health, safety and welfare at work of all their employees (HSWA74 section 2); and
ii) conduct their undertakings in such a way as to ensure that persons not in their employment who may be affected thereby are not exposed to risks to their health and safety (HSWA74 section 3).

9.2 In addition, the NIA65 requires that in the case of nuclear installations, no one can construct or operate such an installation without a nuclear site licence. Section 7 of the Act places duties on the licensee in respect of nuclear occurrences.

9.3 In the UK, therefore, the holder of a nuclear site licence is responsible for the safety of its nuclear installations and also for the health and safety of its employees and members of the public that may be affected by the installations' operations. The non-prescriptive licensing regime in the UK ensures that the licensees recognise and accept their responsibilities whilst allowing them to determine their own methods for meeting the law. The way in which this responsibility is carried out is monitored and, if necessary, safety improvements are enforced by the HSE as described in Annex 6.

9.4 In regard to the financial responsibilities of the operator for potential damages to the public or the environment, British Energy is insured against its liabilities and the Government has its financial responsibilities as a contracting party to the Paris and Brussels Conventions. HSE seeks assurance from DTI on the issue of liability before issuing a nuclear site licence but does not have any review responsibilities.

GS-R-1 2.3: Compliance with the requirements imposed by the regulatory body shall not relieve the [licensee] of its prime responsibility for safety.

9.5 The UK's legislation for health and safety, HSWA74 does not provide a route whereby the regulatory body can relieve the licensee of its responsibility for safety.

GS-R-1 2.3: The [licensee] shall demonstrate to the satisfaction of the regulatory body that this responsibility [for safety] has been and will continue to be discharged.

9.6 Once a reactor design has been accepted for licensing, HSE determines after discussion with the licence applicant those topics to be dealt with in the applicant's safety submissions. These safety submissions describe the safety case for the nuclear installation. They typically cover the licensee's management and organisation structure, design safety principles and criteria (and a safety report showing how these are met), fault studies and quality management. This safety case is assessed by HSE as described in Article 14. During construction and commissioning a number of hold points are agreed at which the licensee must receive HSE's Consent to proceed (see Annex 2). This would only be granted when HSE is sure that the licensee's responsibilities for safety are being met satisfactorily, and that an adequate safety case has been made for the next stage to commence.

9.7 Once a nuclear site licence has been granted, NIA65 enables HSE to attach any conditions to the licence that may have a bearing on safety. Currently, HSE attaches 36 Conditions to a nuclear site licence that in effect envelope all the requirements for the effective management of nuclear safety. These Licence Conditions (LCs, listed in Annex 5) cover matters such as the need to set operating limits, to provide a list of competent persons, to draw up operating, test and maintenance activities, to manage radioactive waste, to report and investigate incidents and to implement adequate arrangements for dealing with accidents or emergencies. Nuclear installation inspectors carry out a comprehensive programme to check that the licensee is complying with its arrangements.

NS.R.2 2.1: The operating organization, as licensee, shall have responsibility for the safe operation of the nuclear power plant. The operating organization shall retain prime responsibility for safety but it may delegate authority to the plant management for the safe operation of the plant. In such cases the operating organization shall provide the necessary resources and support. The management of the plant shall ensure that the plant is operated in a safe manner and in accordance with all legal and regulatory requirements.

9.8 A particularly important aspect of a licensee's safety case is its management and safety organisation. HSE requires that the licensee's safety policy and organisational structure are documented as part of the licensing process. This document sets out the senior management structure, the health and safety responsibilities of key staff and, in particular, how health and safety performance is monitored and reviewed. The licensee ensures that its organisation maintains effective control of operations that take place at the licensed sites for which it is responsible. The licensee's organisation also acts as an intelligent customer when contracting out work that could have an impact on safety. An intelligent customer understands the safety case for the plant and can manage the work of contractors ensuring that the when goods and services are procured, the safety implications are fully understood.

9.9 All UK nuclear licensed sites have a designated site manager who acts as the Agent of the Licensee. The site manager is responsible for all day-to-day activities and operations. This includes responsibility for compliance with specified aspects of the nuclear site licence. The licensees have centrally based staff that, for example, set safety and operational standards, carry out reviews of safety and provide specialist support for a number of licensed

sites. The responsibility for compliance with some site licence conditions for a specific site may be held centrally by the licensee.

NS.R.2:
2.14. The operational safety of a plant shall be subject to surveillance by a regulatory body independent of the operating organization.
2.15. Mutual understanding and respect between the regulatory body and the operator, and a frank, open and yet formal relationship, shall be fostered.
2.16. The operating organization shall submit or make available documents and information in accordance with the requirements of the regulatory body.
2.17. The operating organization shall develop and effect a procedure for reporting abnormal events to the regulatory body in accordance with established criteria.
2.18. To enable the regulatory body to perform its functions, the operating organization shall render all necessary assistance and shall grant access to the plant and documentation. When so required by the regulatory body, the operating organization shall undertake special analyses, tests and inspections. The operating organization, in view of its responsibility for safety, shall make its opinion known to the regulatory body as a basis for subsequent discussions if it considers that any action requested of it by the regulatory body could have an adverse effect on safety.

9.10 The most frequent interfaces between the licensee and HSE arise through the assessment of safety cases and inspections at nuclear licensed sites by HSE to check the operator's compliance with licence conditions and other legal health and safety requirement. HSE nominates an inspector to each site to lead on this regulatory work (Article 14). The processes of assessment and inspection provide HSE with assurance that the licensee meets its responsibilities with respect to the licence conditions and safety case. The HSWA74 gives inspectors the power to enforce relevant legislation at nuclear installations by imposing administrative sanctions against the licensee or its employees if appropriate, as described at Annex 3.

9.11 The licensees and HSE also have a formal hierarchy for meetings to address and resolve issues arising from the regulatory processes, see table 9.1 below.

Table 9.1: Licensee – HSE meeting interface levels		
TYPE	**MAIN BUSINESS**	**AUTHORITY**
Level 1	Strategic plans and priorities Safety and regulatory strategy Consider matters raised from Level 2 Monitor overall progress	Establish plans Resolve issues Action plans for lower levels
Level 2	Implement safety and regulatory strategy Plan for key stages in licensing programme Consider major regulatory/safety issues Consider matters raised from Level 3 Identify issues to be raised at Level 1	Agree Strategy Agree major stages Resolve/refer issues Action work at Level 3
Level 3	Discuss and agree programmes of work Progress resolution of regulatory issues Progress resolution of specific issues Consider matters raised from Level 4 Identify issues to be raised at Level 2 Formalise agreements	Agree programmes Resolve/refer issues Action work at Level 4
Level 4	Gather and exchange information Test understanding Identify issues to be raised at Level 3	No authority (but can refer issues to Level 3)

9.12 Representatives at the four levels of meeting from the licensee and regulator are as follows in Table 9.2:

Table 9.2: Representation at formal meetings between the regulator and licensee.		
	HSE	**LICENSEE**
Level 1	HM Chief Inspector of Nuclear Installations Inspector	Relevant Licensee Chief Executive Officer
Level 2	Deputy Chief Inspector of Nuclear Installations	Licensee Executive Team (Managing Director, Directors of operations, engineering, safety and regulations, etc.)
Level 3	Superintending Inspector of Nuclear Installations and other inspector grades as necessary	Licensees Managers and Group Heads and supporting staff.
Level 4	Nuclear Installations Inspectors	Licensees supporting staff.

ARTICLE 10 - PRIORITY TO SAFETY

"Each Contracting Party shall take the appropriate steps to ensure that all organisations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety."

The Regulator's (HSC's and HSE's) priority to nuclear safety

10.1 HSC's and HSE's business is to ensure that risks to people's health and safety from work activity are properly controlled, in ways that are proportionate to risk, allow for technological progress and pay due regard to cost as well as benefits. They act in close consultation with those whom they regulate or who are affected by work activities; and promote better management of health and safety, through systematic approaches to identifying hazards and assessing and controlling risks.

10.2 It should be noted that the UK's non-prescriptive, goal setting regulatory system is not 'self-regulation'. Rather, in relation to nuclear licensed sites the Conditions attached to the Nuclear Site Licence are designed to encompass the overall management of nuclear safety at the site. Licensees are required to submit a licence compliance statement to show how they comply with the requirements of the licence. HSE, when satisfied with the compliance statement requires the licensee to comply with the Licence Condition arrangements.

10.3 The Sizewell B and Hinkley C public Inquiries [27,28] were set up on behalf of the relevant Secretary of State under the legislation at the time (Electric Lighting Act 1909 and Electricity Act 1957). The Secretary of State appointed eminent legal Counsels as "Inspectors" to preside over the two inquiries. The Inspectors were assisted in technical matters by a number of eminent experts. Any person or organisation, UK or foreign, could volunteer evidence. The Inspectors were free to choose the methodology and the way of evaluating evidence, within broad terms of reference chosen by the Secretary of State. The findings were made available in published reports.

10.4 The Sizewell Inspector reported on the total safety process so that the whole process need not be subject to a similar degree of public scrutiny within a future Inquiry. The system of nuclear installation regulation in the UK was acceptable to the Inspectors at both public inquiries

NS-R-1 3.1: 3.1. The operating organization has overall responsibility for safety. However, all organizations engaged in activities important to safety have a responsibility to ensure that safety matters are given the highest priority. The design organization shall ensure that the installation is designed to meet the requirements of the operating organization, including any standardized utility requirements; that it takes account of the current state of the art for safety; that it is in accordance with the design specifications and safety analysis; that it satisfies national regulatory requirements; that it fulfils the requirements of an effective quality assurance programme; and that the safety of any design change is properly considered. Thus, the design organization shall:
(1) have a clear division of responsibilities with corresponding lines of authority and communication;
(2) ensure that it has sufficient technically qualified and appropriately trained staff at all levels;
(3) establish clear interfaces between the groups engaged in different parts of the design, and between designers, utilities, suppliers, constructors and contractors as appropriate;
(4) develop and strictly adhere to sound procedures;
(5) review, monitor and audit all safety related design matters on a regular basis;
(6) ensure that a safety culture is maintained.

10.5 There are no nuclear installations (nuclear power plant) under construction in the UK. However, the licensee is responsible for safety and is required to be an inteligent customer to ensure that any proposed reactor design meets its safety requirements.

NS.R.2, 2.2: The operating organization shall place special emphasis on safety in operation. It shall establish and effect policies that give safety matters the highest priority. Although the operating organization may already have an organizational structure for managing non-nuclear power plants, the special emphasis on safety will necessitate more than merely an extension of the existing organizational structure.

10.6 The UK's nuclear installation licensees are committed to giving due priority to nuclear safety. This commitment is reflected in the companies' annual reports, as indicated below.

BNFL (Magnox Electric) Vision and Principles

10.7 BNFL's policy and values are given in the Environment, Health and Safety Annual Report for 2002/3, from which the following text has been extracted.

BNFL believe that 'nothing is more important than the protection of the environment and the health and safety of the workforce, contractors and public. Excellence in environment, health and safety (EH&S) is an integral part of our business and is essential to our commercial success.

'BNFL'S EH&S policy is by seeking continuous improvement to achieve and maintain excellence in EH&S and operational performance.

'Our primary goal is that no harm should result from our activities and that we will be respected and trusted by our workforce, the public and our stakeholders. In pursuing this we will work in partnership with employees and contractors at all levels in BNFL, and will strive to:

- eliminate injuries and ill-health at work and minimise radiation doses;
- prevent incidents, but nevertheless maintain effective emergency arrangements;
- prevent pollution and minimise waste and the use of natural resources as part of our contribution to sustainability and environmental improvement;
- ensure the safe disposal or storage of radioactive and other waste;
- achieve and sustain an excellent safety and environmental culture;
- learn the lessons from events, implement corrective actions and seek out and use good practices wherever we may find them;
- ensure that our activities, products and services are in compliance with applicable legislation and meet the requirements of good practice and applicable standards of EH&S performance.

In doing this we will:

- consult our employees on EH&S matters of mutual interest
- listen to and respond to our customers, shareholder, suppliers and neighbours
- openly report our EH&S performance every year
- work with our regulators, the rest of our industry and our customers and contractors to raise EH&S standards
- inform, instruct, train and develop the people who work for us and ensure that competent EH&S advice is available
- audit the management system which flows from this policy, and set and review EH&S objectives and targets, working within a quality framework.
- maintain high standards in the conduct of our operations, in particular by ensuring that they are adequately resourced and carried out by suitably qualified and experienced people and with regard to nuclear safety at all times.'

British Energy:

10.8 The British Energy web site at www.british-energy.co.uk/corporate/safety gives details of its health, safety and environment report for 2002 – 2003.

> "British Energy Generation's [BEG] safety management arrangements are an integrated part of our general management process. All our staff are involved in maintaining and improving safety standards. Formal consultation is through Health and Safety Committees (HESACs) at all locations. These are playing an increasing role in helping to improve safety culture and developing new approaches to health issues."

10.9 British Energy: Health and Safety Policy - the "Board of the Company will:

- Promote Health and Safety actively, giving priority to providing safe and healthy working conditions, safe plant and premises, and safe systems of work, to ensure, so far as is reasonably practicable, the safety and well being of staff, visitors, contractors and the general public;
- Work with staff and their representatives to improve Health and Safety, including consultation through Health and Safety Committees, for the company as a whole and locally at each company site.
- Deploy an effective Health and Safety management system, which ensures compliance with relevant legislation and embodies principles of continuous improvement in occupational Health and Safety awareness and performance
- Promote a culture of co-operation and open communication in which every opportunity is taken to learn from actual and potential failures of the Health and Safety arrangements and no unfair blame is placed on individuals.
- Monitor regularly the effectiveness of these provisions and arrangements. This will include benchmarking against external standards using the International Safety Rating System (ISRS) and independent Peer Review against the World Association of Nuclear Operators (WANO) Performance Objectives and Criteria.
- Ensure that the policy and the implementation arrangements are reviewed regularly and revised as required."

10.10 A UK nuclear installation licensee takes measures that seek to ensure that it has an understanding of the safety significance of any expertise bought in from outside the organisation and the licensee is in a position to take responsibility for the resultant effects on the site's safety. In addition, the licensee oversees and takes responsibility for its contractors' or consultants' activities to ensure that the use of such resources does not compromise either the licensee's chain of command or the licensee's ability to control activities on the nuclear licensed site. As stated previously this knowledge base within the licensee's organisation is known in the UK as being an intelligent customer.

Management functions' priority to nuclear safety issues

British Energy:

Organisation

10.11 British Energy has two nuclear operating companies, British Energy Generation (UK) Ltd. in Scotland and British Energy Generation Ltd in England. These are the nuclear licensees. British Energy is currently restructuring and relicensing, further details will be given in the UK presentation at the third Review Meeting.

Executive responsibility

10.12 Responsibility for Health, Safety & Environmental performance within each of the licensees lies with the Board of that company. The Chief Executive of British Energy plc is the Chairman of each of the licensee companies and has executive responsibility for ensuring that the company operates safely and complies with legislative and regulatory requirements. He/She is also responsible for ensuring that those appointed to the Boards of licensed subsidiaries or who influence strategic direction in areas which impact on nuclear safety are suitably knowledgeable on nuclear industry requirements and standards.

Generation Division

10.13 Within the Generation Division the Boards of the two nuclear operating companies have identical composition and meet jointly. The Chairman has specific responsibility to oversee the maintenance of high levels of safety and environmental protection within the Company. To assist in this task the Director, Health, Safety and Environment reports directly to him/her on these matters. Accountability for Health, Safety & Environmental performance is fully integrated into the line management of the licensees and is monitored through the normal management accountability process.

Nuclear Safety Committee

10.14 On all matters related to nuclear safety the UK nuclear operating companies take advice from their Nuclear Safety Committees. These committees include independent members with extensive experience and knowledge in the field of nuclear safety.

Safety and Regulation Division

10.15 The UK nuclear operating companies also have a Safety and Regulation Division charged with independently scrutinising their arrangements and performance.

NS.R.2, 2.3: Consideration shall be given to … review of the overall safety performance of the organization in order to assess the effectiveness of safety management and to identify opportunities for improvement.

British Energy: Review and audit

Peer Evaluation

10.16 Peer Reviews against the Performance Objectives and Criteria set by the World Association of Nuclear Operators (WANO) take place at all UK nuclear power stations, as at the majority of nuclear power stations around the world. The Performance Objectives and Criteria provide a detailed description of the characteristics of a safe and reliable nuclear power plant under 10 general headings:

- Organisation and Administration
- Operations
- Maintenance
- Engineering support
- Training and qualification
- Radiological protection
- Chemistry
- Operating experience
- Fire protection
- Emergency preparedness

10.17 The peer review programme identifies strengths and good practices, which are shared between the UK nuclear operators and internationally with other WANO members. It also identifies improvement areas. In recognition of the benefits of performing these reviews, British Energy has increased their frequency so there is now a programme to undertake a review at each station every 3 years.

British Energy: WANO Corporate Review

10.18 During the year 2002-3 British Energy carried out a self-assessment to measure progress against the WANO corporate review areas for improvement. This self-assessment included a number of international peers. It was very helpful in improving the action plans.

British Energy: Planning & implementing, Work management system

10.19 BEGL and BEG(UK)L are now well advanced in the deployment of a new work management system covering a broad range of work activities from managing plant modifications to managing stores, from recording data to producing reports, from tracking actions at meetings to planning outages. These new processes bring substantial safety benefits though uniform application of best practice in areas such as control of the release of plant for maintenance and its return to service, rigorous application of risk assessment, utilisation of suitably qualified personnel and alignment of documentation with plant configuration.

10.20 Nine sites (seven power stations, Barnwood and Peel Park) are now live on the new Work Management System, which replaces the diverse legacy systems and underpins the new

common set of processes. Implementation at Dungeness B is planned for summer 2004.

10.21 A Generation Business Support Team has been established to support the users in achieving full process alignment and the benefits from the new Work Management system. The Company is also looking how best to maximise the productivity and plant reliability improvements enabled by the Work Management approach.

NS.R.2, 2.5: A document describing the plant's organizational structure and the management arrangements for discharging all these responsibilities shall be made available to the regulatory body for review. In addition, proposed changes to the structure and associated arrangements which might be significant to safety shall be systematically reviewed by the operating organization and shall be submitted to the regulatory body for review.

10.22 This is achieved through meeting LC36, which can be found at Annex 5.

NS.R.2, 2.6: Clear lines of authority shall be established to deal with matters bearing on plant safety.

Allocation of responsibilities

10.23 The licensees' arrangements provide an effective allocation of responsibility between corporate functions and the local managers. Reporting to the Board of Directors there are a number of Divisional Directors or senior managers that run divisions responsible for certain aspects of the company's activities. Divisional Directors also report to a Chief Executive with the responsibility for the day to day running of the company. A company includes divisions having responsibilities for Operations, Technology and Engineering aspects and Health and Safety. The Health and Safety Division has a special status as it reports directly to the Chairman of the Board or Chief Executive. In this way it has **authority and independence** from the company's commercial activities.

10.24 The **Operations Division** provides a co-ordinated management system for the operation of the nuclear installation. For example, the Station manager can be responsible for: a nuclear installation or group of nuclear installations situated at one site; implementing the company's safety policy; and ensuring that safety responsibilities are effectively discharged. Where this is the case, the Station manager reports to the Divisional Director and is also responsible for maintaining operational standards, improving safety performance and managing any safety assessments to ensure that they are effectively carried out and that relevant requirements are implemented.

10.25 The central Divisions that provide services to all sites include **Technology and Engineering Divisions** responsible for providing technical support to Station managers for the preparation, development and assessment of the nuclear installation safety cases. These or other Divisions include specialist functions covering such aspects as fuel performance, fault studies, structural integrity, human factors, operational experience feedback, quality assurance and support for technical training standards.

10.26 The **Health and Safety Division** seeks to ensure that appropriate health and safety policies and standards are formulated and promulgated throughout the company. It provides advice and monitors independently the effectiveness of and compliance with the company's

health and safety policy. The monitoring programme includes independent on-site inspections and reviews of the various health and safety performance indicators. The Division has responsibilities for all health and safety issues that include: safety standards and independent assessment of nuclear installation safety cases; radiation protection; independent audit, surveillance and review. It also forms a view on the adequacy of quality assurance arrangements.

NS.R.2, 2.11: All activities that may affect safety and which can be planned in advance shall be conducted in accordance with established procedures which shall be submitted by the operating organization to the regulatory body for approval, if so required.

British Energy:

Operating rules

10.27 Key to the safe operation of our power stations is the quality of the procedures and guidance available to operational staff. Following successful experience at Sizewell B BE are recasting the Operating Rules and Instructions at the AGR stations into a similar format. This structure, known as "Technical Specifications", is the approach in use at most high performing nuclear plant around the world. Two key benefits will flow from this:

- The AGR Technical Specifications more clearly identify the limits and conditions within which the Station must be operated and relate them to the requirements of the safety case.

- They identify the actions to be taken if these limits and conditions cannot be met and the time limits within which those actions must be carried out.

10.28 The move to a common structure at BE's nuclear installations will bring significant benefits, including opportunities for replication and in the areas of operator training and flexibility.

10.29 An infrastructure has been developed for the AGR Technical Specifications, governing such things as the authoring rules, the generic framework and the additional arrangements required when modifying Technical Specifications. The infrastructure encapsulates Company and international best practice, and ensures consistency across stations. Training modules have been produced for authors and verifiers involved in Technical Specification modification. The format of these Technical Specifications is identical to that in use at Sizewell B Power Station. Their content is based on the limits and conditions specified in the existing Operating Rules and Identified Operating Instructions at these stations.

10.30 Technical Specifications have been implemented at all Stations. On completion of the implementation programme a generic review will be carried out in order to ensure that best practices are delivered to all British Energy sites.

10.31 All AGR stations with experience of operating under Technical Specifications report an overall improvement in Nuclear Safety culture and an increase in the availability of Nuclear Safety related plant.

Training Standards and Expectations

10.32 Following the best practice established by World Class Nuclear Operators a set of ten high level standards and expectations have been issued to all BE staff. One of these relates to Training and Competence:

"One of the most critical requirements for safe and reliable nuclear power plant operations and maintenance is the availability of sufficient numbers of competent personnel. The Suitably Qualified Experienced Person process ensures that we define the necessary competencies for carrying out work and only allocate work to people who have been properly trained and are judged competent."

Revised Approach to Training

10.33 To assist the achievement of the high standards of nuclear safety and performance required, a review of training has been undertaken and the recommendations from the review have been approved by the Licensees' Boards. These include:

- The establishment of a company level overview of training and identification of performance shortfalls, which would be addressed via training;
- Increased professional training support to line managers through the augmentation of site based training resource;
- The creation of a Training forum to share best practice, apply generic solutions and reinforce company standards; and
- A company wide Training needs Analysis carried out in conjunction with line managers

Monitoring Training Standards

10.34 The company's Training Standards and Accreditation Board (TSAB), with its independent members continues to monitor safety related training programmes. Additionally, peer evaluations are carried out through the WANO Peer evaluation and Assist programmes and includes areas relating to Training and Qualification. The WANO evaluations are evenly interspersed with the TSAB evaluations. A recent Company WANO evaluation recognised the TSAB as a healthy self-evaluation process to support the continuous improvement of training. The second round of full site evaluations are well underway and include the simulator evaluations that are now fully integrated in the process after their successful relocation to sites.

BE work management system

10.35 BEG is now well advanced in the deployment of a new work management system covering a broad range of work activities from managing plant modifications to managing stores, from recording data to producing reports, from tracking actions at meetings to planning outages. These new processes bring substantial safety benefits though uniform application of best practice in areas such as control of the release of plant for maintenance and its return to service, rigorous application of risk assessment, utilisation of suitably qualified personnel and alignment of documentation with plant configuration.

10.36 Nine sites (seven power stations, Barnwood and Peel Park) are now live on the new Work Management System, which replaces the diverse legacy systems and underpins the new common set of processes. Implementation at Dungeness B is planned for summer 2004.

10.37 A Generation Business Support Team has been established to support the users in achieving full process alignment and the benefits from the new Work Management system. The Company is also looking how best to maximise the productivity and plant reliability improvements enabled by the Work Management approach.

NS.R.2, 2.12: When activities are proposed that are not included in the normal procedures, special procedures shall be written in accordance with established administrative procedures.

10.38 Operating Rules define the envelope within which the plant normally operates. Occasionally, the plant condition may move outside this envelope and corrective action is promptly taken that returns the plant conditions back within the Operating Rule boundary. It is very improbable that an event would occur that would result in the plant condition moving significantly outside the Operating Rule boundary. Should this occur symptom-based emergency guidelines are provided that advise the operator on appropriate action to ensure plant safety. If the event led to core damage, further guidelines are available to advise the operator on the safest action to take.

ARTICLE 11. FINANCIAL AND HUMAN RESOURCES

"1. Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.

2. Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life."

1. Financial resources

11.1 Under UK law, a registered company must have sufficient assets to meet all of its liabilities if it wishes to continue in business. A balance sheet of assets and liabilities is a required element of the annual accounts, which under UK law must also be audited and made available to the public. The published accounts for the UK's nuclear installation operators are on their web sites [29,30].

11.2 The cost of operating a nuclear installation is determined by taking into account: the repayment of the capital costs; the operating costs; and liabilities, particularly from fuel reprocessing and decommissioning. To determine the capital cost each nuclear installation was assigned at the start of its life an accounting period. The nuclear installations operated by BNFL are beyond their accounting period and it has an arrangement with the UK Government, its owner, to account for the operating and liabilities costs. For British Energy, AGR stations lives of 25-35 years and for the PWR a life of 40 years are currently adopted. Achievement of a nuclear installation's life is subject to ongoing satisfactory periodic safety assessment. The charge for depreciation of these assets is based on the 'straight line' method to write off the initial cost over their estimated useful lives.

11.3 However, the actual lifetimes of the plants may be different from their assumed accounting lifetime depending upon such things as economic, technical and safety factors. Special financial provision is made for the particular liabilities relating to the reprocessing and storage of spent fuel, the storage and disposal of nuclear waste and the nuclear installation's decommissioning costs. In particular, BE's decommissioning costs are to be met from a segregated fund, established for this purpose when the company was created.

Financing safety improvements during operational life

11.4 The costs of making any necessary safety improvements during the operating life of a nuclear installation are treated as part of the installation's normal operating costs identified in paragraph 11.2. The principal elements of operating costs comprise:

- fuel (including the cost of new fuel and treatment of irradiated fuel);

- materials and services (the cost of engineering, including contractors, and consumable spares for maintaining the nuclear installations, and other miscellaneous charges such as insurance);
- staff costs (salaries and pension provisions); and
- depreciation (representing the proportion of the fixed assets written off in relation to the accounting life).

11.5 As with any other expenditure, the operators' internal financial control processes determine the necessary authority required before commitments are made to make safety or any other improvements. These processes will examine the impact on the operators' financial accounts of any proposal for improvement work using discounted cash flow and cost-benefit analyses. Such analyses will take into account both the immediate costs of carrying out the improvements and future income through continued electricity generation.

Financing radioactive waste management at nuclear installations

11.6 The published audited accounts of UK nuclear installation operators include details of waste management costs and of the provisions made in order to meet them. However, there is currently no disposal route for intermediate and high level radioactive waste (ILW and HLW) in the UK. The costs of storing these wastes comprise:

- costs actually incurred during the operational phase; and
- liabilities associated with the management of ILW and HLW before ultimate disposal during the decommissioning phase.

11.7 The cost of managing radioactive waste during the operational phase is an operational cost spread across the materials and services and staff costs in the reported accounts. The materials and services costs in the accounts include costs associated with disposals of low level radioactive waste (LLW) where the operator of the LLW facility sets a price that reflects all operational and liability cost considerations. (All disposals of radioactive waste during the operational phase, including those to the environment, are undertaken in accordance with regulatory authorisations. The regulator (either the EA or SEPA) recovers its costs in granting, monitoring and enforcing the authorisations from the operator).

Financing decommissioning programmes

11.8 In November 2001, the UK Government announced radical changes to current arrangements for the clean up of Britain's nuclear legacy. These arrangements will be funded by the taxpayer. The aim is to manage the clean up process better by setting up a new public body, the Nuclear Decommissioning Authority (NDA). The NDA will provide the strategic direction for cleaning up Britain's civil public sector sites, including Magnox reactors. Further information on the NDA can be found at the following weg site: http://www.dti.gov.uk/nuclearcleanup

11.9 UK Government policy recognises that decommissioning should proceed as soon as reasonably practicable, taking into account all relevant factors, such as: the benefits of delayed action in radioactive dose optimisation to the public, workers and the environment; the availability of disposal routes for the radioactive wastes; and (subject to ensuring public safety) the financial implications of deferring or delaying work and costs.

11.10 As experience is gained on decommissioning and dismantling nuclear installations and other facilities, the technical assessments and cost estimates are refined. Since 1995 the decommissioning strategies of nuclear installation operators require review by the regulators every five years. There is therefore an incentive, from both the financial and regulatory requirements, for decommissioning strategies to be maintained and developed in line with current knowledge. To date, the actual costs for initial dismantling and preparation for storage have been below estimates, demonstrating that the estimates used were cautious.

11.11 The costs of removing fuel and loose radioactive materials from a reactor and related costs are treated as part of the plant's normal operating costs.

11.12 The Nuclear Decommissioning Agreement provides for a fund run by trustees which is tasked with meeting all the costs of decommissioning BE‘s UK nuclear stations. The fund receives predetermined contributions from BEG(UK)L and BEGL, which are reassessed quinquennially to ensure that there are adequate assets to meet the liabilities. The arrangements were set out in full in the British Energy Share Prospectus [31]:

> "Nuclear Generation Decommissioning Fund Limited was incorporated on 28 March 1996 for the purpose of providing arrangements for funding certain long term costs of decommissioning British Energy's power stations. It is owned by the trustees of an independent trust ("The Nuclear Trust"). Three of the trustees are appointed by HM Government and two appointed by British Energy. The ratio of independent directors of the fund company to those appointed by British Energy is the same. "
>
> "In the Nuclear Review, HM Government concluded that segregated funds were the best way of ensuring public confidence that Nuclear Electric and Scottish Nuclear would meet their decommissioning obligations and that the costs of meeting these long term nuclear liabilities did not fall to taxpayers by default. In connection with the privatisation of British Energy arrangements have been made for a segregated fund. The structure and scope of the fund have been agreed by the NII [HSE], which is also satisfied that the arrangements are sufficiently flexible to accommodate changes to the companies' decommissioning strategies."

11.13 Financial details of the British Energy liabilities fund are set out in the annual accounts. It includes contributions in the financial year; the basis for the contributions was in the BE Share Prospectus. Under the Energy Act of 2004 ownership of the Magnox nuclear installations’ assets and liabilities will pass to the NDA. The transfer is planned to occur in April 2005. At that time all existing decommissioning provisions will be transferred to the Nuclear Decommissioning Fund Account held by Government.

11.14 Under the proposed restructuring of BE, the company will continue to make contributions to the Nuclear Generation Decommissioning Fund, which will be subsumed into a new Nuclear Liabilities Fund (NLF). BE will also make additional contributions to the NLF, which will be underwritten by the UK Government to the extent there is any shortfall to ensure safety and environmental protection.

Licensees' Management of Human Resources for Safety Related Activities

Regulatory Background

11.15 HSW74[6] places responsibility for safety on the plant operator. This responsibility includes the training of staff with safety related roles. Specific requirements are included in the Management of Safety Regulations [20], in particular Regulation 13 on Capabilities and Training.

11.16 In addition, several licence conditions set goals on training and the management of human resources. LC 10 (see Annex 5) requires the licensee to make and implement adequate arrangements for suitable training of all those on site who have responsibility for any operations which may affect safety. LC12 requires the licensee to make and implement adequate arrangements to ensure that only suitably qualified and experiences persons perform duties that may affect safety. This includes the appointment of duly authorised persons to control and supervise specific safety related operation.

11.17 The licensees' arrangements made under other licence conditions such as plant modification procedures (LC 22), emergency arrangements (LC 11) and the control of corporate structure (LC36) also require that the licensee should address human resource and training issues.

11.18 HSE's role is to monitor the adequacy of, and compliance with, the arrangements made under the licence conditions. Under normal circumstances, HSE does not have any specific role in the selection, training and authorisation of staff to perform safety related duties. It does however have powers to intervene if, in its opinion, any person is unfit to perform the duties of a duly authorized person.

11.19 Training and human resource issues are addressed by nuclear inspectors when they are reviewing safety documentation requirements against the SAPs [26]. The requirement is that provisions are made for training staff who will have responsibility for the safety of the plant. These include a management system for training on the site, analysis of jobs and tasks, development of training methods, assessment of trainees, revision training as required and regular evaluation of training. Thus, licensees have in place a systematic approach to training and assessment of personnel with safety roles. Analysis of tasks provides an input to the specification of personnel training. Emphasis is placed on training that enables staff to implement accident management strategies, utilising appropriate instrumentation and items of plant that are qualified for operation in severe accident environments.

11.20 In order to comply with Regulatory requirements, a licensee must demonstrate to HSE's satisfaction that it has:

- lines of authority leading to adequate control of the activities whether by the licensee's own staff or contractors;
- adequate staff resources;
- precise definition and documentation of duties;
- integration of health and safety responsibilities into job functions;
- appropriately trained experienced staff ensuring adequate in-house expertise; and

- the provision of, or access to, a high level of health and safety expertise used in an active role for the peer review of the safety case, audit and review.

This demonstration is achieved by the preparation of adequate arrangement to satisfy the requirements of the relevant licence conditions.

Licensees' Training Programmes

NS.R.2, 3.1: The operating organization shall define the qualifications and experience necessary for personnel performing duties that may affect safety.
NS.R.2, 3.3: A suitable programme shall be established and maintained for the training of personnel before their assignment to safety related duties.

11.21 For all tasks undertaken on site, licensee's and contractors' staff receive training: to make them aware of the safety hazards on the site; and in the use of preventive and protective measures established to reduce risks to health and safety. Licensees ensure, for each post or role with a responsibility for safety, that the duties and responsibilities and competencies are identified and that the training needs of an individual are met.

11.22 The assessed competence of an individual to undertake a specific task is achieved by a combination of:

- knowledge, academic and practical qualifications, assessed training and experience of the person;
- the instructions and information provided to the person; and
- the degree of control and supervision exercised in carrying out the task.

Training requirements are then identified that are dependent on the needs of the job and the assessed competence of the individual. Procedures for assessing competence prior to undertaking a safety related job are part of the arrangements made under LC10. Although the responsibility for evaluating an individual suitability for a specific job rests with the licensee, NII will as part of its inspection programme, inspect the adequacy and implementation of the licensees' training programmes

11.23 Licence condition 12 requires that any posts on site that may effect operational safety or implement actions connected with the site licence conditions must be done by suitably qualified and experienced persons. These are known as Duly Authorised Persons. The responsibility for appointing these persons rests with the licensee. However the NII inspectors will again inspect adequacy and implementation of the process. HSE has powers under the Site licence to require that the licensee ensures that no person continues to act as a duly authorised person if, in the opinion of the Executive, he is unfit to do so.

NS.R.2, 3.5: The operating organization shall ensure that the qualifications and training of external personnel performing safety related duties are adequate for the functions to be performed.

11.24 When licensees use contractors for safety related work, they satisfy themselves that the contractors' staff have the appropriate qualifications and training to undertake the tasks safely. Training of contractors' staff in Site Safety Rules is part of the contractual agreement.

11.25 When safety analysis work and/or inspection work (e.g. NDT examination) is contracted to organisations external to the licensee, HSE advocates the "intelligent Customer" approach. This means that the licensee should have sufficient in-house expertise to manage (and if necessary, challenge) the work of contractors.

11.26 In the UK, licensees are responsible for ensuring the safety on the licensed site and are required under Licence Condition 17 to have quality assurance arrangements for all matters that might affect safety. Licensees are therefore responsible for ensuring, amongst other things, that its contractors are fitted for the work that they do. HSE has guidance for its inspectors on judging whether licensees and contractors meet their safety responsibilities, and this guidance is available to licensees. It does not specifically prescribe the qualification, quality systems or performance of contractors but it does carry out inspections of the licensees' quality assurance arrangements. For critical components, such inspections may also involve examination of the quality assurance arrangements of suppliers or contractors. However it is always the licensees' responsibility to ensure that these arrangements are adequate.

NS.R.2, 3.6: The training programme shall include provisions for periodic confirmation of the competence of personnel and for refresher training on a regular basis.

11.27 The performance of employees is assessed continually by their line management. In addition, periodic formal appraisals are undertaken and recorded. In either case, corrective and development actions are identified and taken as necessary. This process is part of the arrangements made under LC10.

NS.R.2, 3.7: The plant manager is responsible for the qualification of plant staff and shall support the training organization with the necessary resources and facilities. Line managers and supervisors shall be responsible for the competence of their personnel. They shall participate in determining the needs for training, and in ensuring that operating experience is taken into account in the training.

11.28 The licensee is responsible for all safety matters. Therefore it is the licensee's responsibility to provide the necessary resources and facilities for training. Failure to do this would breach the requirements of LC10.

11.29 The need for training in terms of the job requirements and the needs of the individual are determined by the licensee's organisation.

NS.R.2, 3.13: A programme shall be put in place to assess and improve the training programmes. In addition, a system shall be in place for timely modification and updating of the training facilities and materials to ensure that they accurately reflect plant conditions.

11.30 The training programmes take into account changes to plant configuration, plant modifications and reaction to incidents on site and on other sites. Plant modification proposals, made under the arrangements under LC22, identify where instructions and procedures need to be changed and the associated training needs. For large modifications that need stage Consents to be granted by HSE, evidence of satisfactory retraining may be a requirement prior to a Consent being granted to bring the modified plant into routine service.

NS.R.2, 3.14: A programme shall be put in place to ensure that operating experience of events at the plant concerned as well as of relevant events at other plants is appropriately factored into the training programme. The programme shall ensure that training is conducted on the root cause(s) of the events and on the identification and implementation of corrective actions to prevent their recurrence.

11.31 LC 7 requires the licensee to develop adequate arrangement for the notification, investigation and reporting of incidents on site. The outcomes of these investigations are reported to HSE. These reports ensure that any training deficiencies are identified and the licensee takes corrective action.

11.32 The adequacy of all training courses is kept under review and takes account of feedback from trainees and their line managers. The training arrangements are the subject of internal audits by the licensee's staff and also routine and team inspectors by HSE inspectors.

NS.R.2, 3.7: Managers and supervisors shall ensure that production needs do not interfere with the conduct of the training programme.

11.33 The conduct of training is an integral part of the arrangements made under LC10. This includes the provision of staff to cover for the work normally done by the trainees.

NS.R.2, 3.9: Training instructors shall be technically competent in their assigned areas of responsibility and have the necessary instructional skills.

11.34 Training instructors comprise staff of proven competence and experience who are employed in the work area in which they provide training and full time instructors normally based at a training centre. Instructors are given training in teaching and instruction methods. Arrangements are in place to assess the performance of instructors by line management and feedback is provided by staff receiving instruction.

NS.R.2, 3.11: Representative simulator facilities shall be used for the training of operating personnel. Simulator training shall incorporate training for operational states and for accidents.

11.35 Computer based simulators are available for all reactor types and form part of the training of plant operators. The simulators are capable of simulating a range of accident conditions.

NS.R.2, 3.12: What instruction is given to plant staff on the management of accidents beyond the design basis?

11.36 This is covered under the response to Article 16 (Emergency Preparedness) and Article 19 (operations).

Technical support resources

11.37 The prime engineering and technical capability of the licensee comprises staff at operating and central locations. These staff provide the in-house resource available to respond to requirements for technical analysis and informed action which are immediate, plant-specific or require specialist knowledge not readily available elsewhere. Where it is economic and practicable, technical services may be procured from suitably qualified and experienced specialists in other utilities or organisations under appropriate contractual arrangements. These arrangements follow the "intelligent customer" approach. Similarly the technical services of the licensee may be contracted to external organisations where it does not compromise the support of the licensee's operating locations. In these areas there may be technical support from, and collaboration with, other licensees.

11.38 Each licensed nuclear site has engineering and technical support staff who know and understand the nuclear safety case and its relationship to the plant and its operational characteristics. These staff are responsible, on behalf of the Station manager, for ensuring that nuclear safety cases are prepared at the location, in the central organisation, or externally. These staff are also responsible for the preparation, review and development of the written instructions that implement the limits and conditions of the nuclear safety case and the assessment of work for radiological significance.

11.39 The central engineering and technical organisation provides technical support to all locations. This includes a broadly based capability and specialists in key technical and safety areas which are recognised as specific to the licensee's reactors and which are not readily and securely available in the external market. These staff understand the design of the stations and the nuclear safety cases that underpin their operation and prepare and modify nuclear safety cases. The central engineering and technical organisation also has access to specialist facilities and support staff to enable it to maintain and develop the necessary knowledge base.

11.40 The Licensee's health and safety function has its own technical capability and access to other technical capability. It is therefore able to carry out independent nuclear safety assessments and peer reviews of new safety cases and modification, experiment and decommissioning proposals.

Plant operation resources

11.41 During the initial licensing process, the licensee makes a safety case that identifies the need and demonstrates the availability of sufficient numbers of qualified staff. This case is reviewed as part of the Periodic Safety Review Process and at other appropriate times (such as relicensing). The licensee's case is reviewed by HSE and its nuclear installation inspectors regularly inspect and assess adequacy of resources. This is also carried out during targeted inspections by human factors specialist inspectors

11.42 Each nuclear licensed site has engineering and technical staff who are suitably qualified, experienced and, where appropriate, authorised to operate, maintain, improve and modify the plant in accordance with its nuclear safety case and after getting the agreement of the regulator (see Article 14). These staff assess work for operational safety significance to establish suitable and sufficient preventive and protective measures and provide the first-line control and supervision of activities that may affect safety.

11.43 Plant improvements and modifications requiring more extensive project management or technical capabilities are carried out by the central organisation on behalf of the Station manager. Where it is economic and practicable, maintenance services are procured from suitably qualified and experienced specialists in other utilities or organisations under appropriate contractual arrangements.

11.44 Project management capabilities are available to support new plants and major modifications on existing plants. These capabilities include the specification of items and services, supervision of contractors and the management of construction, installation and commissioning of plant.

ARTICLE 12. HUMAN FACTORS

"Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation."

12.1 The UK's nuclear installation operators and regulators recognises that human performance plays an important role in ensuring the safety of a nuclear installation throughout every stage of its life cycle - from design, construction, commissioning and operation through to decommissioning. Human factors are concerned with all aspects of human performance, and the factors affecting this performance, which can impact on the safe operation of a nuclear installation. Therefore human factors analyses are applied as appropriate to all activities and functions related to nuclear safety.

NS-R-1 5.48: The design shall be 'operator friendly' and shall be aimed at limiting the effects of human errors. Attention shall be paid to plant layout and procedures (administrative, operational and emergency), including maintenance and inspection, in order to facilitate the interface between the operating personnel and the plant.

12.2 No new nuclear installations are being designed in the UK. However, for the more modern nuclear installations safety-related structures, systems and components were designed and laid out to facilitate inspection, maintenance, modification, repair and replacement. All nuclear installations have periodically been reassessed and where reasonably practicable upgraded to more modern standards.

12.3 The licensees carried out fault analyses to identify initiating events that may occur due to human error and to identify operator safety actions. For the more modern nuclear installations, where a plant failure or incorrect operation leads to a need for safety system operation, the plant was designed so that it was rendered safe by the action of passive or engineered features.

12.4 The probabilistic safety assessment (PSA) undertaken on the nuclear installations provided quantitative assessments of the risk to safety arising from plant designs and operations. The PSAs highlighted significant contributors to risk, and took into account the impact of human activities and operations on safety. The licensees ensured that all relevant operator actions were identified in the PSAs, and suitable methods were used to assess the potential errors associated with these actions and to determine human error probabilities.

NS-R-1 5.49: The working areas and working environment of the site personnel shall be designed according to ergonomic principles.

12.5 Task analyses, based on ergonomic principles, provided a primary input to inform decisions on plant staffing, and on the equipment and other facilities that we provided to support the operator. This was important for the design of the user interface, and also provided a basis for developing procedures and the content of personnel training. Task analyses influenced the way in which the jobs were organised, as well as being used to determine the feasibility of individual tasks.

NS-R-1 5.50: Systematic consideration of human factors and the human–machine interface shall be included in the design process at an early stage and shall continue throughout the entire process, to ensure an appropriate and clear distinction of functions between operating personnel and the automatic systems provided.

12.6 Analyses instigated by the licensees of the safety functions and actions required of the operators demonstrated that tasks were feasible, and that they would be performed safely and reliably in the time available. Where appropriate, task analyses were carried out to identify the operator actions required to monitor the plant, diagnose plant state, make decisions and implement actions. It took account of the physical, physiological and cognitive demands, which may be placed on the operator and on teams of operators. It addressed the potential consequences of failure to perform the safety actions successfully, and the potential for recovery from error.

12.7 The initial stage of the human reliability analyses identified potential human errors that could impact on safety. The error identification processes were rigorous and thorough. They enabled the specification of all human errors that could reduce the reliability of the systems being examined.

12.8 Quantitative estimates of human error probability were produced for the significant human errors defined during the error identification processes. The probabilities reflected influences on performance arising from psychological factors and other task-specific factors (e.g. stress, the physical environment, training, working practices, time constraints, adequacy of procedures and User Interface, etc.).

NS-R-1 5.52: Verification and validation of aspects of human factors shall be included at appropriate stages to confirm that the design adequately accommodates all necessary operator actions.

12.9 The potential for dependencies between separate operator actions (either by the same or by different operators) was assessed and the results were factored into the nuclear installation PSA. The potential for recovery from previous errors was also examined - this was especially pertinent where long timescales are available to take corrective action. The licensees identified potential improvements as part of these analyses and used this information to ensure that risks were reduced as low as reasonably practicable (ALARP).

12.10 Human factors analyses required scrutiny of design processes in order to confirm that due consideration was taken of human factors issues. They also required an examination of the way in which human factors principles were implemented in practice throughout the life cycle of the nuclear installations.

NS-R-1 5.56: The design shall be aimed at promoting the success of operator actions with due regard for the time available for action, the physical environment to be expected and the psychological demands to be made on the operator.

12.11 The design of the User Interface followed good human factors practice, to ensure that it was compatible with human psychological and physical characteristics and to enable the required tasks to be performed reliably and efficiently. For any new design, a structured User Interface design process was adopted and relevant standards were applied. In particular, the User Interface for the reactor Main Control Room (MCR) was based on a comprehensive and systematic task analysis, which identified the operational requirements during normal, transient and fault conditions. The User Interfaces of existing nuclear installations were subject to scrutiny during the PSR processes (see Articles 6 and 14) in order to ensure that they remain fit for purpose.

NS-R-1 5.51: The human–machine interface shall be designed to provide the operators with comprehensive but easily manageable information, compatible with the necessary decision and action times. Similar provisions shall be made for the supplementary control room.

12.12 The design of the reactor control room enables the operator to carry out safety functions and tasks during normal operations, postulated fault conditions and, where practicable, severe accidents. Adequate provisions are available in the control room and at emergency locations to enable the monitoring of plant state in relation to safety, and the taking of any necessary safety actions. Due attention is given to the specification and design of local control stations and to equipment employed during other activities which have the potential to impact upon plant safety (for example, maintenance and testing equipment and computer-based systems used to present operating instructions).

12.13 The nuclear installation licensees consider environmental factors in their analyses of operator actions, including noise, thermal and lighting conditions, communications facilities and the design of the workplace.

Managerial and Organisational human factors issues

SS 115, 2.28: A safety culture shall be fostered and maintained to encourage a questioning and learning attitude to protection and safety and to discourage complacency, which shall ensure that (a) policies and procedures be established that identify protection and safety as being of the highest priority.

12.14 All the UK licensees have clear positions on the importance of safety in their 'Company vision' statements and in the goals of their corporate business plans. Placing the maintenance and improvement of safety alongside other business goals has brought benefits in terms of wider staff involvement. In particular, monitoring the safety improvement activities through the same 'accountability review' process as other business activities ensures that they are given appropriate priority. It also reinforces the message that they are part of the core business.

12.15 One company has set improvement of leadership as a particular business goal. Each business unit is performing a self-assessment using the European Foundation for Quality Management business excellence model to identify the most important areas for improvement. Another technique being applied is the use of Safety Enhancement Plans for developing, communicating, understanding and monitoring the strategy at each site to improve safety and safety culture. These form part of each location's business plan and outline the activities that will be undertaken to improve safety in the plan year. A mechanism is also provided for staff to contribute ideas for improving safety. Specific safety enhancement 'enablers' and 'results' are in each licensee's station business plans.

12.16 Yet another technique being used is the International Safety Rating System (ISRS) to set improvement targets across the full range of safety management activities. Managers are accountable for improvements in each area.

12.17 The safe operation of the plant depends on the technological systems and on the people who interact with those systems. Both of these factors are affected by the safety management systems and safety culture at the installation. In recognition of this, licensees have formal management systems and procedures, which seek to ensure safe operation. In addition HSE introduced a specific licence condition (LC36), through which the licensee demonstrates to HSE’s satisfaction that it has appropriate policies and procedures.

12.18 The importance of appropriate management systems is recognised in the UK's Health and Safety legislation. The Management of Health and Safety at Work Regulations (1999) [20] are of general application to any work activity. HSE has issued guidance on 'successful health and safety management' to industry concerning the elements of a successful health and safety management system that are appropriate to meet these statutory requirements (HSG65) [32]. These include:

{ clear health and safety policies;

{ good organising and planning functions;

{ provisions to monitor and measure performance; and

{ an auditing, review and feedback process.

12.19 The HSE's SAPs [26] include a section concerned with management systems. Formal provisions for the investigation and reporting of events are also an explicit requirement.

12.20 While licensees have formal management systems and procedures to assure safe operation, they also recognise the importance of having a positive safety culture. The nuclear licensees know that developing a good safety culture involves gaining the commitment and enthusiasm of staff involved in plant safety, as well as instituting good management procedures. A range of initiatives enhancing safety culture have been implemented. The suitability of a particular type of initiative will vary from licensee to licensee and on the prevailing culture within and between that company's sites. For example, safety culture is being enhanced through organisational approaches, such as the involvement of staff in TQM (total quality management), regular safety communications (newsletters, seminars etc.), safety performance monitoring, audits and reviews, safety awareness training, and provision of adequate resourcing for operational feedback.

SS 115, 2.28: A safety culture shall be fostered and maintained to encourage a questioning and learning attitude to protection and safety and to discourage complacency, which shall ensure that:
(b) problems affecting protection and safety be promptly identified and corrected in a manner commensurate with their importance.

12.21 At existing nuclear installations, operations are controlled and carried out in accordance with Operating Rules (ORs) or Technical Specifications (Tech Specs) that define, or refer to lower tier documents that define, the limits and conditions necessary for the plant to remain within a safe operating envelope. Instructions are provided in order to implement the OR and Tech Spec limits and conditions and to support examination, inspection, maintenance, testing activities and plant operations. Written instructions support correct operator performance and ensure that operations are performed in a well-defined and controlled manner.

12.22 The licensees ensure that the technical content of instructions are correct, and that the design and presentation of instructions enable users to follow them accurately and reliably. The instructions are subject to verification and validation processes to ensure that they accurately represent operational requirements and are compatible with the design of plant and equipment. The licensees provide suitable arrangements to implement the ORs, Tech Specs and instructions.

SS 115, 2.28: A safety culture shall be fostered and maintained to encourage a questioning and learning attitude to protection and safety and to discourage complacency, which shall ensure that:
(c) the responsibilities of each individual, including those at senior management levels, for protection and safety be clearly identified and each individual be suitably trained and qualified.

12.23 All the operators have continuing programmes of safety awareness training to ensure that all staff appreciate the potential impact of their work on safety. Additionally, all the companies have used training programmes based around the STAR (Stop, Think, Act, Review) concept to provide a tool for individual safety improvement.

12.24 One operator developed a special safety awareness training pack for first line supervisors and training covering strategic safety matters for senior managers. Another operator uses the STAR concept as an integral part of investigations as to why something happened. These investigations sometimes highlight non-application of the STAR principles and the resultant consequences. Likewise, correct application of STAR techniques that result in avoiding potential safety incidents are identified. The lessons to be learned are communicated to staff at team talks and group meetings as part of the continuing process of emphasising the advantages of the STAR techniques.

12.25 The licensees seek to involve staff in a range of improvement initiatives, to promote personal development and awareness. All staff have taken part in Safety Culture seminars, and, following significant human performance events, all personnel involved participate in the preparation of a report for the Station Incident Panel and the Company Safety Supervisory Board.

SS 115, 2.28: A safety culture shall be fostered and maintained to encourage a questioning and learning attitude to protection and safety and to discourage complacency, which shall ensure that:
(e) organizational arrangements and lines of communications be effected that result in an appropriate flow of information on protection and safety at and between the various levels in the organization of the registrant or licensee.

12.26 Each licensee is striving to continually improve its approach to event reporting, for example, by encouraging the reporting of abnormal conditions or 'near-miss' events. Improvements to the communication process are encouraged by the use of ISRS within each company. Particular examples are: greater coverage by team briefing and other corporate information services; regular group safety meetings; involvement of supervisors and mangers in face to face informal discussions with staff on topics chosen by the staff.

12.27 To gauge company culture the licensees have conducted general staff attitude surveys and specialist safety culture surveys. The lessons learned from these surveys are fed into the business planning process to inform the location's safety enhancement activities.

12.28 At many nuclear installations pocket booklets have been developed in specific areas explaining management's expectations of standards and bridging the gap between training and procedures. Some, for example, promote better understanding, with responsible station and contractor personnel being clearly identified and photographed; other pamphlets apply to individual departments.

12.29 One operator has established a Contractor Safety Forum at each nuclear installation that enables station management to involve contractors' management in agreeing safety objectives and measures. These forums have helped improve communications both between the licensee and individual contractors and between different contractor companies.

12.30 A continuing concern with feedback and review processes is the potential for new activities and corrective actions to be spawned more quickly than the existing ones are completed. All the companies are aware of weaknesses in this area and, for example, one has recently increased focus in this area by requiring stations to set targets on completion of actions arising from Peer Evaluation and event investigation. Another operator has also made the completion of actions a specific objective. A third has long established Incident Panels which place and track all actions associated with events.

Further points to make

12.31 The UK licensees have a system for reporting receipt and assessment of reports of nuclear plant events and are members of World Association of Nuclear Organisations (WANO), and as such share operating experience internationally. In addition, the HSE operates the IAEA's Incident Reporting System (IRS) on behalf of the UK. Nuclear utilities co-operate in programmes of Peer Evaluation and Operational Experience Feedback. Also, they participate in the programmes of WANO, the IAEA and the Institute of Nuclear Power Operations (INPO), which give an international perspective on performance levels. As well as the professional, focused critique which a station gains from an Evaluation or an IAEA Operational Safety Review Team (OSART) mission, the many staff who help conduct such reviews bring home valuable insights and ideas, which can be applied at their own stations.

Regulators Assessment of Human Factors

12.32 The HSE's SAPs [26] form a basis against which the regulatory assessment of human factors is carried out. They identify explicitly the need for a nuclear licensee to consider a comprehensive set of influences on human performance.

12.33 Regulatory assessment of the licensee's treatment of human factors is made throughout the life cycle of a nuclear installation. When a safety case is submitted to HSE, nuclear site inspectors, project managers and human factors specialists agree on the scope of any human factors assessment work that is appropriate to the case in question. HSE ensures the licensees place considerable emphasis on the inclusion of human factors analysis in the early stages of plant design in order to ensure that the design properly reflects the capabilities and limitations of human performance.

12.34 Some aspects of human factors are specifically addressed by the nuclear site LCs (e.g. LC 10 - Training, LC 12 - Suitably Qualified and Experienced Persons), and compliance with these LCs is monitored as part of the nuclear site inspectors' normal duties. To ensure this is done effectively HSE's nuclear installation inspectors are trained to identify human factors concerns and when found they discuss them with the licensee or raise with HSE's specialist human factors inspectors.

12.35 The HSE's human factors inspectors proactively identify areas of the licensees' operations for examination based on their awareness of issues which have been raised from a variety of sources, including national and international operating experience, developments in human factors techniques and research, and discussions with HSE and licensee personnel. HSE also maintains exchange arrangements on human factors, and other technical areas, with regulatory bodies and research establishments in other countries.

12.36 The HSE carries out targeted inspections of human factors-related issues. Such inspections provide confidence that the licensee's human factors analyses are implemented in practice. All areas of human factors can be examined in this way, but particular emphasis is given to targeted inspection of the licensee's management of safety and training arrangements. This reflects not only the significance of these areas, but also the fact that they can be subject to more regular change than other factors such as the User Interface.

12.37 With regard to assessment of safety culture, HSE considers it important that the licensees 'own' their safety culture. It is considered neither practicable nor desirable to compel a licensee to adopt a culture advocated by the regulator. The regulatory approach to this issue, therefore, is to seek information that allows HSE to make judgements about the licensee's safety culture, by reviewing indicators of plant and personnel performance, and to use these observations to encourage and support licensee initiatives to promote improvements.

12.38 NuSAC (see paragraph 7.39) has produced documents on 'Training' and 'Organising for Safety [33,34] which have informed the UK awareness of, and approach to, safety culture - the attitudes, values and practices which emphasise and maintain safety as the overriding priority.

ARTICLE 13 - QUALITY ASSURANCE

"Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation."

13.1 This article has been addressed by considering the quality assurance issues arising from the IAEA's requirements document 50-C-Q on "Quality Assurance for Safety in Nuclear Power Plants etc." [35] This document describes quality assurance (QA) in terms of 10 Basic Requirements, which have been used to structure the following text. The one heading that is not included is Basic Requirement 2 on training and qualification, which is addressed under Article 11.

Basic Requirement 1: QUALITY ASSURANCE PROGRAMME

50-C-Q, 201: Management shall develop, implement and maintain a quality assurance programme. The quality assurance programme shall include details of how work is to be managed, performed and assessed … The quality assurance programme shall include the organizational structure, functional responsibilities, levels of authority and interfaces for those managing, performing and assessing the adequacy of work. The quality assurance programme shall address management measures, including planning, scheduling and resource considerations.

13.2 Licensees' QA programmes are developed as part of their arrangements to meet LC 17 that addresses QA issues. They meet the requirements of national and international quality management Codes and Standards. In addition to including all the relevant elements of those documents the programme is also the vehicle by which all other arrangements required to be made under the nuclear site licence are identified, referenced and controlled.

13.3 Collectively these arrangements provide a description of organisational structures and detail the arrangements for such things as the control of documentation, the provision of control and supervision, the establishment and maintenance of competency, the management, control and verification of work and the audit and review of performance.

50-C-Q, 202: The responsible organization shall also be responsible for the establishment and implementation of the overall quality assurance programme. If the responsible organization delegates to other organizations the work of establishing and implementing all or a part of the overall programme, it shall retain responsibility for the effectiveness of the programme in all circumstances.

13.4 LC 17 requires the licensee to make and implement adequate quality assurance arrangements in respect of all matters that may affect safety. Licensees develop, as part of these arrangements, quality programmes for the applicable stages in the plant life cycle e.g. design, construction or operation. The licensee delegates the establishment and implementation of these programmes to other organisations where appropriate. The licensee retains responsibility for the effectiveness of the programme by the approval of the programme or elements of the programme, the approval of and involvement in quality plans and through a number of processes including, where appropriate, supervision, audit and review of contractors activities.

50-C-Q, 203: The quality assurance programme shall provide an interdisciplinary approach involving many organizational components and shall not be regarded as the sole domain of any single group. The quality assurance programme shall demonstrate the integration of the following three principles:
(1) managers provide planning, direction, resources and support to achieve the organization's objectives;
(2) staff performing the work achieve quality; and
(3) staff performing assessments evaluate the effectiveness of management processes and work performance. The quality assurance programme shall be binding on everybody.

13.5 The licensees' QA programme is an integral part of the development and control of arrangements made under the nuclear site licence. These arrangements clearly identify the key responsibilities of managers and others in related documents who carry out the work. Responsibilities and processes are identified for monitoring, audit and review to ensure that management processes and work performance are effective. These activities are integrated such that the specification, execution, supervision and monitoring of the work are properly resourced and carried out. When specific quality/inspection plans are used there is a clear link between the activities of managers, supervisors, operators and verifiers all of whom record their involvement.

50-C-Q, 204: A graded approach based on the relative importance to nuclear safety of each item, service or process shall be used. The graded approach shall reflect a planned and recognized difference in the applications of specific quality assurance requirements.

13.6 Graded application of QA is used by the licensees in such a way that there is a hierarchy of controls applied to activities depending on the safety significance of the plant to which the activity is carried out. The approach ensures that appropriate levels of supervision, inspection, monitoring, documentation, training and audit and surveillance are applied according to the safety significance of the plant and the potential for error leading to the possibility of severe consequences. Licensees use a well established process that allocates a QA grade to an activity. This grade relates to the measures applied to the activity to ensure that it is carried out to the specification requirements and that proper records are maintained. The process is also applied to contractors that are carrying out work on licensed sites where an element of control will involve the licensee and may also, for the highest QA grades, require the involvement of an independent third-party inspection body.

Basic Requirement 3: NON-CONFORMANCE CONTROL AND CORRECTIVE ACTION

50-C-Q, 207: Items, services and processes that do not meet specified requirements shall be identified and the safety impact of the non-conformances assessed and reported to the appropriate level of management.

13.7 Items, services and processes that do not meet requirements are identified by the licensees through a number of processes including, receipt and in-process inspections, contract reviews, supervision, monitoring and audit activities, all of which are required to be carried out as part of the QA programme. The level of reporting of a non-conformance depends on its nature, its potential effect on nuclear safety, its cost and its affect on the licensee's programme. Defective items and services can result in the supplier being barred from supplying in the future by being removed from the approved suppliers list. Close-out of non-conformances identified through audit and review processes are reported to management and if no corrective action is taken within a prescribed time-scale the reporting is escalated to senior management for appropriate action. The details of non-conformances are entered, with other data such as incidents and accidents, onto databases where the data is analysed and developing trends identified.

50-C-Q, 208: To ensure improvement, the causes of such non-conformances shall be determined and action taken to prevent their recurrence. Item characteristics (such as reliability), process implementation, experience and other quality related information (including management processes) shall be reviewed and the data analysed to identify improvements.

13.8 One of the main reasons the analysis described above is carried out by the licensees is in order to identify any underlying causes. Licensees do this as part of the process of ensuring that the non-conformance will not recur. Underlying causes (such as inadequate supervision, lack of training or incorrect documentation) have been identified and corrective action taken. Learning from errors and mistakes as part of an operational experience programme is an essential part of a well developed quality management system and is a requirement of the nuclear site licence.

Basic Requirement 4: DOCUMENT CONTROL AND RECORDS

50-C-Q, 209: Personnel using documents shall be aware of and use appropriate and correct documents.

13.9 The development and use of Electronic Document Management Systems (EDMS) by licensees has provided both a means of making individuals aware of what documents need to be read/referred to and ensuring that the latest issue of the document is available. Electronic messages with appropriate tags alert targeted individuals of new or modified documents. The identification of the modifications within the documents could be improved in some instances. In parallel with these systems some licensees operate a 'directed reading' approach that ensures that personnel are made aware of important changes and are instructed to read the amended documents. For maintenance activities dedicated software applications are used such that work instructions are made available in hard copy to those carrying out the

work. Where lower-tier hard copy documents are controlled via a manual system, improvements can be and are being made.

50-C-Q, 210: Records relating to personnel and records that describe the status, configuration and characteristics of items and services, describe the performance of processes and represent objective evidence of quality shall be specified, prepared, reviewed, approved and maintained. All records shall be legible, complete and identifiable. A records system shall be established to provide for the identification, collection, indexing, filing, storing, maintenance, retrieval and disposal of records. Retention times of records and associated test materials and specimens shall be established to be consistent with the type of records, material and specimens involved.

13.10 The UK's licensees have quality assurance departments to ensure appropriate quality assurance standards are maintained. In addition, the nuclear site licence requires that in addition to operational records, records that demonstrate compliance with licence conditions must be preserved. Licensees have developed systems, taking into account the guidance provided in IAEA 50-C-Q, that state the record to be preserved, allocate its retention period, that classify what media is appropriate to store the record and that identify the storage conditions in which it will be stored. Record condition review periods are being established to ensure the continued readability of records and with advances in technology checks are made to ensure data remains accessible and that computer applications remain supported. With regard to the storage and identification of test specimens and materials, these are generally stored in acceptable conditions. Currently reviews are underway to ensure that the identification and storage of such records remains acceptable. The long-term storage of radiographs has proved more problematical with some deterioration taking place.

Basic Requirement 5: WORK

50-C-Q, 301: During all stages in the life of the nuclear power plant, work shall be planned and performed in accordance with established codes, standards, specifications, practices and administrative controls. Work shall be performed under controlled conditions, using approved current instructions, procedures, drawings or other appropriate means that are periodically reviewed to ensure adequacy and effectiveness.

13.11 See 50-C-Q 209 and paragraph 13.9 above. Licence Conditions require all work that is safety related must be done in accordance with written instructions. The licensees' arrangements ensure this and HSE nuclear installation inspectors check for compliance. HSE has very little evidence of non-compliance. All procedures and work instructions are allocated a review period including a 'review on use' designation. Each document has an 'owner' who reviews the document to ensure that it reflects the current situation (including changes required by amendments to the plant and/or process) and that it continues to reflect acceptable practice. The undating of documents including drawings affected by an amendment was a problematic area. However, the increasing use of EDMS and similar systems has improved this situation significantly.

50-C-Q, 303: Equipment used for process monitoring, data collection, and inspections and tests shall be of the proper range, type, accuracy and precision.

13.12 An integral part of licensees' maintenance systems is the maintenance and calibration of measuring and test equipment (M&TE). Many of these instruments when being used for data collection, in addition to their measurement function, are part of an electronic data recording system that removes the need to manually transcribe data, which not only eliminates transcription errors but also significantly reduces the potential for falsification of data. Calibration systems are well established. An integral part of these systems is the specification and procurement of appropriate M&TE and also, where necessary, independent certificated calibration services. Recent improvements in licensees' systems has involved the traceability of M&TE, when found to be outside calibration limits, to the exact location or test in the plant for which it had been used over the last usage period.

Basic Requirement 6: DESIGN

50-C-Q, 304: Design, including subsequent changes, shall be carried out in accordance with established engineering codes and standards, and shall incorporate applicable requirements and design bases.

13.13 Licensees have safety case control systems in place for the production and verification of changes to the nuclear installations' safety cases. In addition, design control systems are in place for new projects and for modifications to existing drawings and specifications. National and international codes and standards are referenced where these apply to the design and/or specification. Control of standards (including company, industry, national and international) is an integral part of the design process. Maintaining knowledge of updates/amendments to national and international standards is generally achieved through membership of standards organisations and as a consequence of being party to the development of the standard in some cases. Computer based codes are subject to verification prior to use.

50-C-Q, 305: The adequacy of design, including design tools and design inputs and outputs shall be verified or validated by individuals or groups other than those who originally performed the work. Verification, validation and approval shall be completed before implementation of the design.

13.14 As the design develops, for significant and novel design projects, the licensees subject the outputs to formal and critical design reviews. There are independent members on the design review teams. The stage designs are assessed to ensure that the design objectives including safety functions will be fully met. Significant design calculations are subject to peer review and in some instances to alternative calculation methods. Safety cases are developed in parallel and reflect the design philosophy clearly justifying the approach. In addition to licensees' controls to ensure that construction does not progress beyond the stage for which design approval has been achieved the UK regulatory approach, based on permissioning, ensures that regulatory hold points are not passed until all approvals have been achieved.

Basic Requirement 7: PROCUREMENT

50-C-Q, 306: Procured items and services shall meet established requirements and perform as specified. Suppliers shall be evaluated and selected on the basis of specified criteria.

13.15 All licensees have established procurement arrangements. An integral part of these arrangements is the evaluation and selection of suppliers and contractors. Over recent years there have been significant efforts made to reduce the number of approved suppliers in order to develop stronger and more stable interfaces with a smaller number of organisations to reduce both costs and variability of quality of service/items/materials. Graded application of QA is central to the evaluation and selection of suppliers. For all purchases/services with a safety implication suppliers/contractors are expected as a minimum to have certification to the appropriate part of ISO 9000:2000 (or equivalent). Tender evaluation panels are held to assess and compare tenders in terms of cost, quality, environmental impact, delivery, past dealings and other factors in order to ensure that the purchasing requirement will be satisfied fully. For safety significant purchases recognition is given to the amount and nature of monitoring and support that the licensee will need to provide to ensure full compliance with the procurement specification and to establish ownership of new plant or system.

50-C-Q, 307: Requirements necessary to ensure the quality of items and services shall be developed and specified in the procurement documents. Evidence that purchased items and services meet procurement requirements shall be available before they are used.

13.16 In line with the concept of the graded application of QA the extent of inspection, monitoring, verification and documentation used by the licensees is dependent on a number of factors including the safety significance of the item/service being procured. Documented arrangements are in place that detail the steps taken to ensure that procured items and services are fit for purpose. These controls can range from receipt inspection of an item to the use of comprehensive quality plans with licensee and independent third party monitoring and hold points. Many items are subjected to in-process inspection by the licensee or the licensee's appointed agent.

Basic Requirement 8: INSPECTION AND TESTING FOR ACCEPTANCE

50-C-Q, 309: Inspection and testing of specified items, services and processes shall be conducted using established acceptance and performance criteria. The level of inspection and testing and the degree of independence of personnel shall be established.

13.17 Licensees inspections and testing are carried out against design specification or contract requirements. Items, services and processes that are important to safety are the subject of quality and inspection plans and/or which identify the criteria against which the inspection and checking is carried out. For services particularly, performance criteria are an integral part of the contract and for non-achievement there are sanctions/penalties.

50-C-Q, 310: Administrative controls, such as hold points and status indicators, shall be used to preclude the bypassing of required inspections and tests. Any inadvertent use, installation or operation of items, services and processes, which have not passed the required inspections and tests shall be prevented.

13.18 The use of quality and inspection plans and licensee arrangements introduce hold points and stages into the manufacture, construction, installation and operation processes. These plans/stages ensure that items, services and processes that do not meet acceptance criteria are prevented from use by devices such as segregation, quarantining or the withholding of approvals for release. In some instances, due to the operation of integrated work management IT applications, unless items have been accepted these are automatically prevented from release.

Basic Requirement 9: MANAGEMENT SELF-ASSESSMENT

50-C-Q, 401: Management at all levels shall regularly assess the processes for which it is responsible. Management shall determine its effectiveness in establishing, promoting and achieving nuclear safety objectives. Management process weaknesses and barriers that hinder the achievement of the nuclear safety objectives shall be identified and corrected.

13.19 In addition to established arrangements for self and independent audit, and operational experience feedback, licensees periodically review their management systems to ensure that these are providing and delivering business objectives which include the achievement of nuclear safety. These reviews use a wide range of information including that from the elements above but also from incident and event data, industry feedback and regulator interface. The output from such reviews will reshape future arrangements, plans and objectives and may result in organisational restructuring. This aspect, a requirement of ISO 9000.2000 [36], has become more developed over recent years.

Basic Requirement 10: INDEPENDENT ASSESSMENT

50-C-Q, 402: Independent assessments shall be conducted on behalf of management to measure the effectiveness of management processes and the adequacy of work performance, to monitor item and service quality and to promote improvement. Independent assessments consist of audits, reviews, cheeks and other methods.

13.20 Audit and review (assessment) is a fundamental element in licensees' quality assurance programmes. As with plant design and operation there is a strong element of defence in depth in the audit and review process. Licensees employ layers of audit and review in self-audit, task independent audit and review, and independent audit and review, some of the latter being carried out by third party organisations. In addition to these levels of audit and review, the regulator carries out as part of its regulatory activities audits and inspections of the licensees' arrangements.

50-C-Q, 404: Persons conducting independent assessment shall not participate directly in the work being assessed.

13.21 The term 'independent' in 'independent assessment' distinguishes between the audit and review carried out by those involved in the work being assessed and that which is carried out by personnel that have no involvement in the work under review. This is achieved in a number of ways including the use of audit and review personnel from a different part of a licensee's organisation, a different site, from corporate resource or from another organisation under contract to the licensee.

50-C-Q, 405: The results of the independent assessments shall be considered by management and, where necessary, actions shall be taken to implement improvements.

13.22 When licensees' senior managements carry out periodic (usually annually) reviews of the effectiveness of the quality management system, information from a number of sources is taken into consideration. This includes the results of all assessments, including independent assessments. On a more frequent basis management is made aware of the output of all audits and assessments. This information is used as the basis for corrective action and/or as an initiator for process improvement.

ARTICLE 14: ASSESSMENT AND VERIFICATION OF SAFETY

"Each Contracting Party shall take the appropriate steps to ensure that:

a. comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;

b. verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions."

14a SAFETY ASSESSMENT

14.1 Tables 14.1 to 14.5 on the following pages provide an overview of the principle nuclear installation life phases that require safety assessment reports. The tables indicate the purpose of the reports and use made by them by the licensee and the regulator, HSE.

NS-R-1, 3.10: A comprehensive safety assessment shall be carried out to confirm that the design as delivered for fabrication, as for construction and as built meets the safety requirements set out at the beginning of the design process.

14.2 The assessment and verification of the safety of a nuclear installation started before construction commenced with the production and development of safety analysis reports by the licensee. The safety case consisted of a tiered set of these safety analysis reports covering a range of topics, from general safety principles through to detailed aspects of design and operation. The licensee "owns", understands, endorses and makes use of the safety case at all stages of the installation's life. The licensee has systems in place to ensure that the plant is operated and maintained in accordance with the requirements and assumptions of the safety case. Comprehensive safety assessments were carried out at the time of construction of the UK's nuclear installations. Under the terms of the licence conditions these safety assessments are updated as necessary during their operating life.

Table 14.1 Principle nuclear installation life phases requiring safety reports

PHASE	LICENSEE'S SAFETY REPORT	PURPOSE
DESIGN	**Design Safety Criteria** **Pre-Construction Safety Report (PCSR)**	Design and safety principles Justify start of nuclear safety related work on site (including licensing). Identify data from commissioning and parallel research and development work to support safety case.
CONSTRUCTION AND COMMISSIONING (including modifications)	**Pre-Operation Safety Report (POSR)** **Station Safety Report (SSR)** is the safety case for nuclear fuel to be loaded into the reactor.	Development of the PCSR during construction and commissioning up to fuel load. SSR is consolidated with further commissioning data until routine operation safety case is established.
OPERATION	**Station Safety Report** **Periodic Safety Reviews** (PSR) - every 10 years	Justifies safety of continued operation and takes strategic look forward to consider the next 10 years.
END OF LIFE SHUTDOWN	Pre-Decommissioning Safety Report Stage II Care and Maintenance Safety Report Periodic Safety Reviews Stage III Dismantling Safety Report	Unloading of Fuel. Justify resources and scope of operations, maintenance, contingency and emergency arrangements.

Table 14.2 Pre-construction Safety Report (PCSR)

PURPOSE	**USE MADE BY:**	
	LICENSEE	**HSE**
To demonstrate to the Licensee and the Regulator the safety of: - detailed design proposals for new plant or major modifications prior to commencement of construction or installation; - the construction and installation activities.	1. To identify design standards and safety criteria. 2. To define the arrangements for management of safety. 3. To demonstrate how the design will meet the licensee's safety criteria. 4. Define the status of safety issues and confirm that any which are unresolved will not prejudice the design. 5. To confirm a Safety Category for the project. 6. To refine the safety specification for detailed design. 7. To allow independent assessors to make a judgement on the adequacy of proposals.	1. To understand the basis of the design and confirm that safety principles and criteria are appropriate. 2. To assess the adequacy of proposals. 3. To determine the extent of Regulatory involvement.

Table 14.3 Pre-operation Safety Report (POSR)

PURPOSE	**USE MADE BY:**	
	LICENSEE	**HSE**
To justify to the licensee and the regulator the safety of: - the design of the facility following construction and installation prior to the start of commissioning; - the commissioning of the facility and any remaining installation activities. The safety case identifies those commissioning tests and inspections required to: - confirm the plant's design safety assumptions and predicted performance, in particular that of the safety provisions; - characterise the plant as a basis for evaluating its behaviour during its operating life. The safety analysis is reviewed in the light of the results of the commissioning programme and any modifications made to the design of intended operating procedures since the commencement of construction.	To describe 'as built' facility and justify any deviation from the proposed design. To identify commissioning arrangements for demonstrating that the design intent and performance have been met or exceeded. To identify schedule of tests necessary or desirable in the interest of safety. To identify contingency plans should the design intent or performance not be met. To confirm design standards and criteria and justify any variation from those previously declared. To define arrangements for management of safety. To identify the plant specific arrangements for complying with the licence conditions and other relevant statutory provisions. To demonstrate how the facility design will meet the licensee's safety criteria. To confirm that any outstanding safety issues have been resolved. To identify any further safety issues which are required to be resolved or the need to invoke the special case procedure. To confirm that any unresolved issues are unlikely to prejudice the commissioning and operation of the facility. To facilitate independent assessment. To refine the safety analysis for all fault conditions. To confirm how the radioactive waste and decommissioning strategies will be implemented.	To identify the plant specific arrangements for complying with the site licence conditions and other regulatory provisions. To identify regulatory issues to be addressed during the commissioning of the plant.

Table 14.3 Station Safety Report (SSR)

PURPOSE	USE MADE BY	
	LICENSEE	**HSE**
Confirm prior to fuel load that the as-built plant meets safety standards and criteria and adequate management arrangements are in place. Consolidate the result of development and commissioning to support safety of routine operations. Consolidate results of subsequent modifications and justifications for continued operation.	Identify the safe operating envelope, including the safety limits and conditions in operating rules. Confirm that operational experience does not affect the safe condition or safe operation of the plant. Identify operational implications for chosen decommissioning strategy. Implementation of the radioactive waste management strategy.	Assess the adequacy of safety of the facility and the basis for consent for routine operation and start-up after statutory shut down. Confirm the extent of further regulatory involvement. Form the basis of regulatory inspection and the examination of arrangements.

Table 14.4 Periodic Safety Review (PSR)

PURPOSE	USE MADE BY	
	LICENSEE	**HSE**
Demonstrate that the plant is adequately safe for continued operation for a period of at least 10 years.	Define the current safety standards and criteria to be applied. Demonstrate how the plant meets the safety standards and criteria. Identify programmes of work including analysis and modifications where reasonably practicable in response to safety issues. Define the arrangements for the management of safety.	Regulatory reassessment of the adequacy of the safety of the plant. Provide input for regulatory inspection of the plant.

Licence Requirements for safety cases

14.3 Some Licence Conditions (LCs) require the licensee to put in place arrangements to ensure that adequate safety documentation is produced. In particular:

- LC 14 "Safety Documentation" requires the licensee to make arrangements for the production and assessment of safety cases consisting of documentation to justify safety during the life of the nuclear installation.
- LC 15 “Periodic Review” gives HSE the power to require a safety justification on anything it specifies.
- LC 16 "Site Plans, Designs and Specifications" requires a reference set of documents for buildings and plant relevant to safety. Declared functions cannot be changed without a formal amendment procedure.
- LC 19 "Construction or Installation of New Plant" requires the provision of adequate documentation to justify the safety of new plant.
- LC 20 "Modification to Design of Plant Under Construction" requires the provision of adequate documentation to justify the safety of any modification.
- LC 21 "Commissioning" requires the provision of adequate documentation to justify the safety of the proposed commissioning activity.
- LC 22 "Modification or Experiment on Existing Plant" requires the provision of adequate documentation to justify the safety of a modification or experiment on the plant.
- LC 23 "Operating Rules" requires the licensee to demonstrate that there is an adequate safety case for any operation that may affect safety.
- LC 28 "Examination, inspection, maintenance and testing" requires the licensee to verify limits and conditions by examination and testing.

NS-R-1, 3.12: The basis for the safety assessment shall be data derived from the safety analysis, previous operational experience, results of supporting research and proven engineering practice.

14.4 The safety case of an installation is the totality of the documented information and arguments that substantiates the safety of the plant, activities, operations and modifications. It demonstrates in writing that the plant, its processes, activities, modifications, etc.:

- Meet the design safety requirements and criteria;
- Conform to good nuclear engineering practice and to appropriate, standards and codes of practice or as appropriate supporting research;
- Are adequately safe during both normal operation and fault conditions;
- Are, and will remain, fit for purpose;
- Give rise to a level of nuclear risk to both public and workers which is ALARP; and
- Have a defined and acceptable operating envelope, with defined limits and conditions, and the means to keep within the envelope.

14.5 The contextual elements of the safety case are:

- Definition of safety (principles, criteria, requirements and standards that need to be achieved);
- Demonstration of safety;
- Implementation of safety; and
- Monitoring and maintenance of the safety case.

14.6 Within this contextual framework the documentation within the envelope of the plant safety case provides a demonstration that the nuclear installation conforms to good nuclear engineering practices and sound safety principles. A nuclear installation is designed against a set of deterministic engineering rules, such as design codes and standards. It uses the concepts of "defence in depth" and "adequate safety margins". To this end, the licensees have developed their Nuclear Safety Principles that set down the deterministic and probabilistic acceptance criteria against which to judge the safety case.

14.7 The safety case provides sufficient information to demonstrate that the engineering rules have been applied in an appropriate manner. In particular, there is a clear demonstration that all equipment important to safety has been designed, constructed, operated, and maintained in such a way as to enable it to fulfill its safety function for its projected life. The safety case also demonstrates compliance with appropriate legislation, for example, the IRR 99 [8] and the Management of Safety at Work Regulations [20].

14.8 The licensees' analyses of normal operating conditions show that resultant doses of ionising radiation, to both members of the work force and the public are, and will continue to be, below regulatory limits and, furthermore, are ALARP (see Article 15).

NS-R-1, 5.69: A safety analysis of the plant design shall be conducted in which methods of both deterministic and probabilistic analysis shall be applied.

14.9 The licensees prepare for their nuclear installation an analysis of faults that could evolve into accidental sequences (initiating faults) and the defences available at the plant to mitigate the consequences demonstrated. The analysis includes the two complementary approaches of deterministic and probabilistic assessment. A comprehensive fault schedule that includes both internal initiating events as well as internal and external hazards is the starting point of both deterministic and probabilistic safety analyses. The deterministic approach is used in the analysis of design basis accidents (DBAs) to demonstrate the capability of the safety systems. Analyses are also undertaken of more severe faults outside the design basis, which could lead to large releases of radioactivity. This includes analysis of the potential failures of the physical barriers to the release of radioactivity, analysis of the magnitude and characteristics of the releases, identification of the accident management strategies to reduce the risk together with the necessary equipment, instrumentation and accident management procedures.

14.10 Probabilistic Safety Assessment (PSA) provides a comprehensive, systematic and numerical analysis of the risk from the plant to demonstrate its acceptability. PSAs for most of the gas-cooled reactors (Magnox and the earlier AGRs) were carried out as part of the Periodic Safety Reviews. For the later AGRs at Heysham 2 and Torness and the PWR at Sizewell B, PSA was used from the design stage. Currently, Sizewell B and the Advanced

Gas Cool Reactors have, or are in the process of establishing, “Living PSA programmes”.

14.11 Safety documentation also provides the basis for the management of safety for people, plant and procedures by addressing: management and staffing levels; training requirements; maintenance requirements; operating and maintenance instructions, rules and contingency and emergency instructions. The operating rules and instructions are identified from the assumptions made in the safety analysis of the safety case.

14.12 The safety case includes a summary document called a safety report. This report and the safety documentation make reference to supporting arguments and evidence, as well as to existing or proposed instructions, procedures, arrangements and standards. The references may range from national or international codes to corporate standards, criteria and procedures that provide requirements for safety and the means to ensure that the process of producing the safety case is properly controlled.

NS-R-1, 3.11: The safety assessment shall be part of the design process, with iteration between the design and confirmatory analytical activities, and increasing in the scope and level of detail as the design programme progresses.

14.13 All the UK’s nuclear installations are into their operation phase. The magnitude, complexity, and development of the safety case through the life of the plant has required the implementation of adequate systems to manage the safety case, use the safety case effectively and correctly update the safety case. In this regard, some UK reactors have recently undertaken major projects to significantly enhance the visibility, traceability, user friendliness and manageability of their safety cases.

14.14 The licensees put system in place to properly manage the changes to the safety case to ensure that the safety case accurately reflects the as-built and as operated plant. Thus the documentation that forms the safety case is subject to appropriate quality assurance procedures discussed under Article 13 and changes to the safety case are regulated as modifications.

14.15 Changes in the purpose and use of a safety case at each stage can involve changes in the organisations responsible for preparing it. At the design stage, the safety case was developed by a design team who eventually handed over responsibility to the operator. QA documentation was required to address these issues in response to LC 17. This documentation defines how information will be transferred, demonstrates that there are mechanisms in place to ensure that responsibilities are clear, and ensures that the case is fully adopted and implemented.

NS-R-2, 5.18: If there is a need to conduct a non-routine operation, test or experiment, it shall be the subject of a safety review.

14.16 LC23 requires the licensee to demonstrate that there is an adequate safety case for any operation that may affect safety.

NS-R-2, 7.4: The operating organization shall establish a procedure to ensure proper design, review, control and implementation of all permanent and temporary modifications.

14.17 In order to meet the licence conditions supplementary documents are sometimes added to the safety case to justify the safety of activities carried out at points in time. For example, a method statement may be prepared to demonstrate that the integrity of plant will be maintained and quality ensured during installation work. Similar type of safety case documentation is produced to demonstrate the safety of temporary plant modifications. These documents define and justify for limited periods of time operations that are necessary, but outside the normal operating envelope described by existing rules and instructions.

NS-R-1, 3.13: The operating organization shall ensure that an independent verification of the safety assessment is performed by individuals or groups separate from those carrying out the design, before the design is submitted to the regulatory body.

14.18 All licensees categorise safety cases and proposals to modify the safety cases, to ensure that the degree of assessment and verification and the clearance route (through independent peer review and a nuclear safety committee) are commensurate with the safety significance. Proposals to change the safety case for a plant are managed by the same process as proposals to modify the plant physically. Typically these require (at the highest level of safety significance) a proposal to be:

- Verified in depth by suitable qualified and experienced persons who have not been involved in preparing the proposal (but may be from the same organisation or working group);
- Assessed as satisfactory as to category and content through an independent nuclear safety assessment by, or to the standards established by, the licensee's health and safety function;
- Considered by the nuclear safety committee (required by LC 13) which includes suitably qualified and experienced persons from outside the licensee's organisation, with the licensee taking due notice of the advice given by the committee; and
- Formally agreed by HSE.

14.19 At the lowest level of safety significance the Station manager authorises and implements the proposal but must prepare sufficient documentary evidence to justify the category allocated, and this evidence is available for auditing, if needed.

14.20 Finally, licensees in the UK also make extensive use of external international peer reviews.

Reviews of the Safety Case

14.21 Periodic Safety Reviews (PSRs) were addressed under Article 6. As well as the PSRs, outage reviews are undertaken every 2 or 3 years. These coincide with the reactor Statutory Outages that are carried out in accordance with LC 30 for the purpose of enabling examination, inspection maintenance and testing.

14.22 Outage reviews demonstrate that adequate safety margins, within current safety standards, exist for the next period of operation (to the next outage). During these reviews,

the focus is on plant inspection results and modifications that were completed during the Outage and confirmation is given to HSE by the licensees that the nuclear installation and procedures are still in accordance with the safety case and that future operations are therefore justified by the current safety case. HSE's Consent to restart the reactor takes account of the findings of the outage review.

14.23 In years where there is no requirement for an outage, a meeting is held by HSE at the nuclear licensed site to review the plant and safety case status to maintain a regular overview of the position.

14b VERIFICATION BY ANALYSIS, SURVEILLANCE, TESTING AND INSPECTION

NS-R-2, 6.1: The operating organization shall prepare and implement a programme of maintenance, testing, surveillance and inspection of those structures, systems and components which are important to safety.

14.24 All UK nuclear installation licensees are required to make and implement adequate arrangements for maintenance, testing, surveillance and inspection of those structures, systems and components that are important to safety. LC 28 "Examination, inspection, maintenance and testing" requires licensees to verify the physical state of all plant that may affect safety by regular and systematic examination, inspection, maintenance and testing. This LC also deals with matters including licensees' preparation of a Plant Maintenance Schedule and dealing with examination, inspection, maintenance and testing findings indicating that the safe operation of plant may be affected.

14.25 LC 30 "Periodic Shutdown" requires licensees to periodically shutdown nuclear installations (referred to as a statutory outage). These statutory outages are for the purpose of examination, inspection, maintenance and testing of plant that may affect safety. Before re-commencement of operation the safety case is reviewed in the light of any findings arising during the previous operational period and during the statutory outage, and the plant must be shown to be safe to operate until the next statutory outage. Periods between statutory outages on nuclear installations vary from 2 to 3 years and must be explicitly defined in the Plant Maintenance Schedule.

14.26 LC 29 "Duty to Carry out Tests and Inspections" requires licensees, after consultation with HSE NSD, to carry out and report the results of tests, inspections and examinations specified by HSE NSD. This LC may therefore be regarded as a verification activity by the nuclear regulator (HSE NSD). Assessment and verification by the nuclear regulator is considered separately later.

NS-R-2, 6.2: The maintenance, testing, surveillance and inspection of all plant structures, systems and components important to safety shall be to such a standard and at such a frequency as to ensure that their levels of reliability and effectiveness remain in accordance with the assumptions and intent of the design throughout the service life of the plant.

14.27 The licensees overall analysis, surveillance, testing and inspection strategies are to ensure that their nuclear installations are kept in accord with overall requirements for their designs. Safety objectives of these overall strategies include:

- The integrity of all safety related plant to meet plant operating conditions;
- That the reliability of plant remains within safety case assumptions;
- That plant operation within safety case assumptions can be demonstrated; and
- That sufficient safety related plant is always available to comply with the safety case.

14.28 Verification by analysis includes using plant information and analytical models to predict that failures due to ageing processes such as creep or fatigue are unlikely in a future period of operation.

14.29 Verification by surveillance, examination and inspection confirms compliance with operating rules and the detection of abnormal conditions before they significantly affect safety. Destructive, non-destructive, continuous and periodic methods are used as appropriate.

NS-R-2, 6.3: The programme shall include periodic inspections or tests of systems, structures and components important to safety in order to demonstrate their reliability and to determine whether they are acceptable for continued safe operation of the plant or whether any remedial measures are necessary.

14.30 UK nuclear installation licensees undertake periodic inspections or tests of systems, structures and components important to safety. Preparation of their overall nuclear installation maintenance and testing programme includes consideration of the nuclear safety case; requirements of safety legislation; requirements of the insurers of plant items; and the recommendations of the manufacturers of the equipment. The programme defines (within the work control system) the activities, who is responsible for their specification and implementation, and the intervals between maintenance activities.

14.31 That part of the programme that is related to meeting the nuclear safety case, and in respect of plant integrity and reliability, is called the Plant Maintenance Schedule, prepared in accordance with the requirements of LC 28.

14.32 In the design phase, diverse and redundant systems and plant are provided to ensure that safety-related systems meet the safety performance criteria, making due allowance for active and passive failures and realistic maintenance requirements. These include issues such as the time taken to perform preventive maintenance and the time taken to correct defects. A key operational issue is that additional plant surveillance and operational constraints are

imposed when an 'urgent maintenance state' arises due to limited plant availability (for testing, preventive maintenance or as the result of plant defects).

NS-R-2, 6.10: Data on maintenance, testing, surveillance and inspection shall be recorded, stored and analysed to confirm that performance is in accordance with design assumptions and with expectations on equipment reliability.

14.33 Licence conditions require the licensees to maintain records of maintenance, testing, surveillance and testing. HSE's nuclear site inspectors review the availability of this information routinely. The results of testing and maintenance of safety-related items and components are also reviewed by the licensees staff, who are aware of the safety case assumptions and preserved in a plant history. This data enables reviews of the appropriateness of the intervals and activities to be undertaken to optimise maintenance work to minimise interference with the plant, operator radiation dose and cost.

Surveillance of compliance with operational limits and conditions

NS-R-2, 5.1: Operational limits and conditions shall be developed to ensure that the plant is operated in accordance with the design assumptions and intent. They shall reflect the provisions made in the final design and shall be submitted to the regulatory body for assessment and approval before the commencement of operation.

14.34 LC 23 requires the licensee to produce a safety case and to identify conditions and limits necessary for safe operation. These are referred to as operating rules. The licensees have systems for implementing and complying with these operating rules. This is achieved by defining a set of safety requirements that are presented to HSE for agreement, and which cannot be altered without HSE's further agreement. They are supported by a hierarchy of operating instructions that define the normal operating limits and conditions, required plant availabilities and plant operating procedures. These are referred to as Technical Specifications and Identified Operating Instructions and compliance with them will ensure that the fundamental plant limits and conditions are respected.

NS-R-2, 5.5: The operating organization shall ensure that an appropriate surveillance programme is established and implemented to ensure compliance with the operational limits and conditions, and that its results are evaluated and retained.

14.35 The licensees have systems for routine compliance monitoring to self-check that they are respecting their Technical Specifications and Identified Operating Instructions. This includes plant surveillance, maintenance checks and administrative checks. The licensees also have an internal regulator who will undertake inspections to verify that the limits and conditions are being respected and that routine surveillances are conducted. Where events of non-compliance occur, the licensees investigate them and report them to HSE in accordance with the arrangements under LC7.

NS-R-2, 5.9: A programme shall be established to ensure that deviations from operational limits and conditions are documented and reported in an appropriate manner, and that appropriate actions are taken in response, including updating the safety analysis report if necessary.

14.36 The licensees have programmes to ensure that deviations from operational limits and conditions are documented and reported. Some nuclear installations use tools to assist operators in addressing compliance with the some of the station's Operating Rules. These assist the operators by indicating whether or not the current plant configurations are compliant with the predetermined permissible plant configurations and, in parallel, carry out a risk evaluation. They have user-friendly interfaces and present risks in a way that can be appreciated by the operators. Logs of all changes in plant configuration and the results of operating rule compliance are retained, which are periodically reviewed to confirm satisfactory operations.

ASSESSMENT AND VERIFICATION BY THE NUCLEAR REGULATOR

14.37 HSE's nuclear installations inspectors check that appropriate standards are developed, achieved and maintained by the licensees. HSE also takes the following actions:

- It confirms that licensees establish, manage and maintain safety requirements for the protection of employees and members of the public;
- It assesses the safety of proposed and existing sites and nuclear installation designs; and
- It inspects nuclear installations for compliance with these requirements at all stages from construction to operation and eventual decommissioning.

14.38 In the course of its nuclear regulatory work HSE scrutinises the activities of licensees both at their licensed nuclear sites and through assessment of the licensees' written safety submissions. This section describes the assessment and verification activities carried out by HSE. Special emphasis is put on describing how the SAPs are used during the assessment of safety case submissions to judge their adequacy.

Regulatory Assessment

GS-R-1, 5.7: Review and assessment shall be performed in accordance with the stage in the regulatory process and the potential magnitude and nature of the hazard associated with the particular facility or activity.

14.39 Tables 14.1 to 14.5 define the stages in the life of the nuclear installation when the HSE requires review and assessment. LC 30 also requires the licensees to periodically shutdown their nuclear installations, which cannot be brought back into service until the HSE is satisfied that a safety case for operation has been made by the licensees.

GS-R-1, 5.8: In connection with its review and assessment activities, the regulatory body shall define and make available to the operator the principles and associated criteria on which its judgements and decisions are based.

14.40 HSE sets safety standards in broad terms for the reviews and assessments using licence conditions, and the TOR principle [37] and SAPs [26] as described in Annexes 7 and 8. In June 2002 HSE published guidance to its inspectors on purpose, scope and contents of the safety cases [37], http://www.hse.gov.uk/nsd under "C key themes of our work, standards and guidance, "HSE Technical Assessment Guide T/AST/051"".

14.41 HSE's SAPs (see Annex 8) form a framework that is used as a reference for technical judgements on the adequacy of licensees' safety cases. They also assist HSE in applying a consistent and uniform approach to its assessment process. In carrying out an assessment, the HSE assessors judge the extent to which the safety submission shows conformity with the relevant SAPs, noting that not all of the principles are applicable to every licensed site or to every assessed safety case submission. Some of the SAPs embody specific statutory limits. Apart from these, the SAPs should be met, so far as is reasonably practicable, which is a requirement of the HSWA74. There can, therefore, only be a rigid interpretation of the principles that reflect statutory limits.

14.42 The SAPs are aimed primarily at the safety assessment of proposed (new) nuclear plants. They are also used in assessing existing plants. In this case the SAPs are augmented by LCs, which require arrangements to be made, procedures written, etc. that take some of the requirements of the SAPs into a form more appropriate to an existing plant.

14.43 For the assessment of existing plants, there is a further point to be considered: the safety standards used in their design and construction may differ from those used in plants designed and built more recently. The existence of such differences is recognised by HSE's nuclear installations inspectors when applying the SAPs in the assessment of modifications to old plants. The ALARP principle is of particular importance to such assessments, and the age of the nuclear installation and its projected life are important factors taken into account when making regulatory judgements on the reasonable practicability of making improvements.

14.44 The majority of the SAPs are engineering (or deterministic) principles. In creating a design there are many choices to be made. Each choice involves to a greater or lesser extent the use of judgement in technical, scientific or commercial issues. Not all of these judgements are concerned directly with safety, but most will influence its achievement. The deterministic SAPs provide inspectors with guidance on what to look for when judging the ALARP arguments in a safety case. They represent HSE's view of good nuclear engineering practice. They point to the provisions that in HSE's view would lead to a safe plant.

14.45 To judge the adequacy of the safety case HSE also uses quantitative comparisons of the safety case numerical elements against the licensee's criteria and against the relevant (probabilistic) SAPs. Probabilistic Safety Assessment (PSA) is used to produce numerical estimates of the risk from the plant and thus provides a very important input to the plant safety case. PSA acts as a crosscheck on the level of safety provision, so that the PSA and deterministic SAPs are complementary.

GS-R-1, 5.9: A thorough review and assessment of the operator's technical submission shall be performed by the regulatory body in order to determine whether the facility or activity complies with the relevant safety objectives, principles and criteria.

14.46 Assessment is undertaken by first understanding and then sampling the key aspects of a safety case using the SAPs[26], and other national and international standards when appropriate, as the yardstick against which to judge them. The technical expertise of the staff is used to select the issues to be pursued in depth. HSE's nuclear project or site inspectors bring together and integrate the findings from assessment of the different technical areas and provide an overall conclusion regarding the adequacy and acceptability of the assessed safety case. This is formally documented in Assessment Reports.

14.47 Extensive discussion between the different technical assessors and the project and site inspectors, together with face-to-face discussions and written exchanges with the technical experts of the licensee, is used to clarify and test the information used, background analysis performed and assumptions made in the safety case. The overall judgement of acceptability is based on the full range of assessment advice. The assessors make recommendations, if appropriate, on where safety can be improved. These recommendations are discussed with the licensee and a programme to implement improvements is usually agreed. If agreement cannot be reached with the licensee, and the issue is considered to be of sufficient importance by HSE, enforcement action to achieve compliance can be undertaken, using the powers discussed in Annex 2.

14.48 The contents of safety cases may vary due to differences in design between different nuclear installations, but HSE's appraisal of the case always addresses three questions:

- Are the objectives of the safety case right?
- Are the details of the safety case right? and
- Has enough been done?

14.49 In answering the above questions, NSD inspectors seek certain attributes in the licensees' safety case submissions. These are:

- Completeness: All reasonably foreseeable threats to safety must be identified and it should be shown that the plant incorporates adequate protection against these threats, or that their contribution to the risk is negligible.
- Clarity: There must be a logical presentation of the plant, system and processes and the safety justification that applies, with clear referencing of supporting information and clear identification of conclusions and recommendations.
- Rationality: The safety case should provide cohesive and logical arguments to support the conclusions.
- Accuracy: The safety case should reflect the 'as is' state of the plant, including processes and procedures.
- Objectivity: The claims in the safety case must be properly tested and checked. As far as is reasonably practicable claims must be supported with factual evidence. The necessary understanding of the behaviour of novel systems or processes should be established from appropriate research and development. The sensitivity of the conclusions to assumptions should be visible.

- Appropriateness: Methods and codes used to demonstrate safety must be fit for purpose with adequate verification and validation.

14.50 If a safety issue is judged to be of sufficient importance then HSE will commission parallel analyses and research to allow additional input into the regulatory judgement process. In addition, if insufficient in-house expertise is available to validate a key safety case claim or if additional views are required, HSE uses external recognised independent experts in the appropriate technical field to help to inform its judgement.

GS-R-1, 5.11: Any modification to safety related aspects of a facility or activity (or having an indirect but significant influence on safety related aspects) shall be subject to review and assessment, with the potential magnitude and nature of the associated hazard being taken into account.

14.51 Not all modifications are reviewed by the regulatory body. However, as described above the licensee prepares sufficient information on the modifications to allow the regulator to decide whether the decision was justified, should HSE decide to undertake a check. Some modifications will be examined as part of the HSE's inspection routine.

GS-R-1, 5.5: At a certain stage in the authorization process, the regulatory body shall take formal actions which will result in either:
(1) the granting of an authorization which, if appropriate, imposes conditions or limitations on the operator's subsequent activities; or
(2) the refusal of such an authorization.
The regulatory body shall formally record the basis for these decisions.

14.52 The points in the lives of the UK's nuclear installations when a regulatory decision to allow the licensees procede have been indicated in the previous text. HSE uses procedures defined in its Business Management Systems to prepare project reports, and records its regulatory decisions and the basis for the conclusions reached in writing.

GS-R-1, 5.12: Regulatory inspection and enforcement activities shall cover all areas of regulatory responsibility. The regulatory body shall conduct inspections to satisfy itself that the operator is in compliance with the conditions set out, for example, in the authorization or regulations.

14.53 HSE carries out planned inspections of nuclear licensed sites to monitor licensees' compliance with the LCs and the general requirements of the HSWA74. An inspector is allocated to the nuclear installation site from the start of construction. This means that frequent inspections and discussions take place, key tests can be witnessed and the test reports checked. In addition, the specialist nuclear installation inspectors who assess the safety case often visit the site and key manufacturers' works. They use their expertise to monitor the construction of components important to safety and they can witness quality assurance procedures. Once the reactor is operational, the nuclear site inspectors spend about 30% of their time on their site. In particular they check that the licensee is complying with the licence conditions.

14.54 Safety audits or team inspections that address specific or more generic aspects of the safety of the nuclear installations are also carried out at the plants and at the Utility corporate

centres. For such actions, a multi-disciplinary group of inspectors will visit the site. They make their findings known to the operator, so that improvements are made, where appropriate.

GS-R-1, 5.14: The regulatory body shall establish a planned and systematic inspection programme. The extent to which inspection is performed in the regulatory process will depend on the potential magnitude and nature of the hazard associated with the facility or activity.

14.55 Individual Site Inspection Plans are produced according to generic templates based on a matrix that includes both LCs and relevant legislation, and the important critical systems (derived from the safety case). They are based on a three-year cycle to ensure that all relevant regulatory requirements and important systems are periodically checked. Before the start of each year the plan is modified, as necessary, to take into account experience, regulatory issues and developments affecting the plant. Unplanned and Reactive Inspection work is also integrated, as necessary, into the Site Inspection activities throughout the year. Site inspectors are supported by other nuclear installation inspectors who carry out specialist assessments or inspections as necessary. The Integrated Enforcement Strategy (IES) developed by HSE embraces the site and corporate inspection processes, together with the assessment processes, (both discussed above) to help provide a consistent and integrated framework for all regulatory activities.

GS-R-1, 5.17: Regulatory inspectors shall be required to prepare reports of their inspection activities and findings, which shall be fed back into the regulatory process.

14.56 Following inspections by the nuclear installations inspector at the nuclear installation, the findings of the inspection are discussed with the licensee and, where appropriate, the corrective actions required from the licensee agreed. Subsequently, an inspection report is prepared by the nuclear installation inspector to record appropriate details of the objectives of the visit, matters considered, conclusions drawn and follow-up actions identified.

ARTICLE 15 - RADIATION PROTECTION

"Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits."

15.1 A summary of the laws and regulations relevant to radiation protection can be found under Article 7.

SS 115: 2.24: In relation to exposures from any particular source within a practice … protection and safety shall be optimized in order that the magnitude of individual doses, the number of people exposed and the likelihood of incurring exposures all be kept as low as reasonably achievable, economic and social factors being taken into account, within the restriction that the doses to individuals delivered by the source be subject to dose constraints.

15.2 Optimisation is the process of determining what level of protection and safety makes exposures to ionising radiations, and the probability and magnitude of potential exposures ALARA. However, in the UK "as low as reasonably practicable", the ALARP principle, is used and is fundamental to all health and safety legislation. The principle requires any nuclear site operator to follow relevant good practice. Where relevant good practice in particular cases is not clearly established the operator has to assess the significance of the risks (both their extent and likelihood) to determine what action needs to be taken. Some irreducible risks may be so serious that they cannot be permitted. At the other extreme, some risks may be so trivial that it is not worth spending more to reduce them. In general, risk-reducing measures are weighed against the associated costs (in time, trouble and money). The licensee takes the measures unless the costs of taking particular actions are clearly excessive compared with the benefit of the risk reduction. The widely used International Commission on Radiological Protection (ICRP) concept ALARA (economic and social factors being taken into consideration) is equivalent to ALARP, but unlike ALARP, does not have the legal precedent in the UK.

15.3 To meet IRR99 regulation 8 the licensees use the following criteria in ensuring that nuclear installations are operated safely:

- all reasonably practicable steps are taken to ensure safe plant operation and to prevent accidents and risks to health at work;
- all reasonably practicable steps are taken to minimise the consequences of any accident involving radiological consequences;
- no person shall receive doses of ionising radiation in excess of the statutory dose limits as a result of normal operation;
- the exposure of any person to radiation and the collective effective dose to staff and the general public, is kept as low as is reasonably practicable; and
- all activities that may affect safety, including those undertaken by contractors, are carried out by, and under the control and supervision of, suitably qualified and experienced persons within an effective management system.

SS 115: Appendis I, I.29: Licensees shall minimize the need for relying on administrative controls and personal protective equipment for protection and safety during normal operations by providing appropriate protective measures and safety provisions, including well engineered controls and satisfactory working conditions.

15.4 The licensees are obliged in UK law to restrict exposure by means of engineering controls such as shielding, physical separation, containment, ventilation and warning devices where these are reasonably practicable, rather than relying solely on systems of work or personal protective equipment. At nuclear installations, whether or not licensees' employees undertake the work, the licensees are responsible for controlling work and ensuring doses to individuals are ALARP.

SS 115: 2.26: The optimization of the protection and safety measures associated with any particular source within a practice shall be subject to dose constraints.

15.5 A dose constraint is a prospective restriction on the individual dose delivered by a source of ionising radiation, which serves as an upper bound on the dose in optimisation of protection and safety for the source. IRR99 regulation 8 requires employers to use dose constraints, where appropriate, in the planning stage of radiation protection. This is achieved through good planning of work activities to restrict individual exposures as far as reasonably practicable. In general the licensees have considerable experience in developing dose databases relating to good practice.

SS 115: Sch II paragraphs 5-8:
II-5. The occupational exposure of any worker shall be so controlled that the following limits be not exceeded:
(a) an effective dose of 20 mSv per year averaged over five consecutive years38;
(b) an effective dose of 50 mSv in any single year;
(c) an equivalent dose to the lens of the eye of 150 mSv in a year; and
(d) an equivalent dose to the extremities (hands and feet) or the skin39 of 500 mSv in a year.
II-6. For apprentices of 16 to 18 years of age who are training for employment involving exposure to radiation and for students of age 16 to 18 who are required to use sources in the course of their studies, the occupational exposure shall be so controlled that the following limits be not exceeded:
(a) an effective dose of 6 mSv in a year;
(b) an equivalent dose to the lens of the eye of 50 mSv in a year; and
(c) an equivalent dose to the extremities or the skin39 of 150 mSv in a year.
When, in special circumstances40, a temporary change in the dose limitation requirements is approved pursuant to Appendix I:
(a) the dose averaging period mentioned in para. II-5 (a) may exceptionally be up to 10 consecutive years as specified by the Regulatory Authority, and the effective dose for any worker shall not exceed 20 mSv per year averaged over this period and shall not exceed 50 mSv in any single year, and the circumstances shall be reviewed when the dose accumulated by any worker since the start of the extended averaging period reaches 100 mSv; or
(b) the temporary change in the dose limitation shall be as specified by the Regulatory Authority but shall not exceed 50 mSv in any year and the period of the temporary change shall not exceed 5 years.
II-8. The estimated average doses to the relevant critical groups of members of the public that are attributable to practices shall not exceed the following limits:
(a) an effective dose of 1 mSv in a year;
(b) in special circumstances, an effective dose of up to 5 mSv in a single year provided that the average dose over five consecutive years does not exceed 1 mSv per year;
(c) an equivalent dose to the lens of the eye of 15 mSv in a year; and
(d) an equivalent dose to the skin of 50 mSv in a year.

15.6 IRR99 regulation 11 specifies dose limits for persons engaged in work with ionising radiation in line with the above limits, but rather to comply with the Euratom Basic Safety Standard, reference 9. As a result, for example, for adult employees the dose limit for whole body exposure is 20 millisieverts (mSv) per year. In practice, all doses recorded for employees at nuclear installations are well below dose limits for normal operations. IRR99 also allow for dose limitation for an individual worker in specified circumstances to be based on a dose of 100 mSv averaged over a period of five consecutive calendar years, with a maximum of 50 mSv in any one year, but only if the licensee can demonstrate to HSE's satisfaction that an annual limit of 20 mSv is impracticable for that person.

SS 115: 2.23: The normal exposure of individuals shall be restricted so that neither the total effective dose nor the total equivalent dose to relevant organs or tissues, caused by the possible combination of exposures from authorized practices, exceeds any relevant dose limit

15.7 Where classified individuals receive exposure from a number of sites "outside worker" provisions of the IRR99 may apply. In such cases individuals are required to carry radiation passbooks, which contain personal identification details together with their cumulative dose. Information in the radiation passbook enables the licensee to properly control combinations of exposures. The ACoP [39] supporting IRR99 gives practical guidance

on the most appropriate methods of complying with the regulatory requirements and hence how to ensure that exposures do not exceed any dose limit and are also ALARP. This guidance covers matters such as: restriction of exposure; information instruction and training; co-operation between employers; designation of controlled and supervised areas; personal protective equipment and its maintenance; and monitoring designated areas.

SS 115: III.2: Licensees shall be responsible for the establishment, implementation and maintenance of protection and safety policies, procedures and organizational arrangements in relation to public exposure, [including] optimisation of the protection of members of the public … and the limitation of the normal exposure of the relevant critical group.

15.8 For the assessment of compliance with dose limits relating to members of the public (IRR99 regulation 11 refers), the licensee is expected to derive realistic estimates of the average effective dose (and where relevant equivalent dose) to representative members of the appropriate reference group for the expected pathways of exposure. Through IRR99 regulation 8 covering ALARP licensees are also required to keep their activities under review to establish whether doses from direct radiation could be reduced.

15.9 Nuclear installations require disposal authorisations for discharge of radioactivity to the environment, burial, incineration or transfer of waste off-site. Authorisations:

- specify the disposal routes to be used and place limits and conditions on disposal;
- place a requirement to use "best practicable means" (BPM) to minimise the activity of radioactivity discharged to the environment and to minimise the radiological effects on the environment and on members of the public;
- require sampling and analysis to determine compliance with authorisation conditions , reporting of the quantities of radioactive waste disposed of, non-compliance with limits; and
- may specify improvements in waste management arrangements.

15.10 The limits on radioactive discharges are set on the basis of the 'justified needs' of the licensees, i.e. they must make a case that the proposed limits are necessary to allow safe and continued operation of the plant. In setting limits, the environment agencies use monitoring, discharge and plant performance data to ensure that the radiation exposure of the public as a consequence of the discharges would be less than the dose constraints and limits set by the UK Government. Currently these are:

- a source constraint of 0.3 mSv per annum for an individual nuclear installation which can be optimised as an integral whole in terms of radioactive waste disposals;
- a site constraint of 0.5 mSv per annum for a site comprising more than one source, e.g. where 2 or more nuclear installations are located together; and
- a dose limit of 1.0 mSv per annum from all sources of man-made radioactivity including the effects of past discharges but excluding medical exposure.

15.11 In addition to the requirements placed on operators to monitor environmental radioactivity around their sites, the environment agencies undertake their own independent monitoring programmes. Radioactivity in surface and ground water, radiation dose rates on beaches and public occupancy areas, radioactivity in sediments and environmental material etc. is monitored. The results of the monitoring are published annually. The Food Standards Agency is responsible for the safety of radiation levels in foods. The environment agencies

and the Food Standards Agency annually publish a joint report [40] on radioactivity in food and the environment in the UK, which also includes estimated doses to the public. Monitoring over the last three years has confirmed that, in terms of radioactive contamination, terrestrial foodstuffs and seafood produced in and around the UK are safe to eat. Exposure of consumers to artificially produced radioactivity via the food chain remained well below the UK public dose limit of 1mSv for all artificial sources of radiation (except medical sources).

SS 115: 2.31: Qualified experts shall be identified and made available for providing advice on the observance of [radiation protection standards.

15.12 At nuclear installations the licensee is required to consult and appoint a radiation protection adviser (RPA) under IRR99 to provide expert advice on measures to restrict exposure and related matters. The HSE has published a statement [41] on RPAs setting out criteria for core competences of individuals and bodies intending to give advice as RPAs. The licensee then has to select suitable RPAs whose experience is appropriate to the advice required.

SS 115: Appendix I, I.26: Employers, registrants and licensees shall, in consultation with workers, through their representatives if appropriate:
(a) establish in writing such local rules and procedures as are necessary to ensure adequate levels of protection and safety for workers and other persons;

15.13 IRR99 regulation17 requires licensees to provide written local rules to identify key working instructions intended to restrict any exposure in a controlled or supervised area. The local rules for a controlled area usually should include: arrangements for restricting access into that area; dose levels; contingency arrangements; identification and description of area covered; and confirmation of the appointed radiation protection supervisor. To meet the requirements of IRR99 regulation 17 covering local rules licensees have put in place arrangements to ensure compliance.

SS 115: Appendix I, I.26: Employers, registrants and licensees shall, in consultation with workers, through their representatives if appropriate:
(b) include in the local rules and procedures the values of any relevant investigation level or authorized level, and the procedure to be followed in the event that any such value is exceeded.

15.14 If an employee has a recorded whole-body dose greater than 15 mSv (or a lower level established by the employer) for the year the employer must carry out an investigation (under IRR99 regulation 8), usually in conjunction with the RPA. The purpose of this investigation is to establish whether or not sufficient is being done to restrict exposure so far as is reasonably practicable.

15.15 IRR99 regulation 25 requires that where a licensees suspects or has been informed of an overexposure in excess of a dose limit, HSE is notified whether this arises from a single incident or through an accumulated dose. The employer undertaking work with ionising radiation must carry out a thorough investigation. To meet the requirements of regulation 25 covering investigation and notification of overexposure licensees have put in place arrangements to ensure compliance.

15.16 Similarly, regulation 30 requires incidents like accidental spillage of radioactive substances to be investigated. LC 34 requires the leakage or escape of radioactive material or radioactive waste to be notified, recorded, investigated and reported in accordance with LC 7 arrangements.

SS 115: Appendix I, I.33: For any worker who is normally employed in a controlled area, or who occasionally works in a controlled area and may receive significant occupational exposure, individual monitoring shall be undertaken where appropriate, adequate and feasible. In cases where individual monitoring is inappropriate, inadequate or not feasible, the occupational exposure of the worker shall be assessed on the basis of the results of monitoring of the workplace and on information on the locations and durations of exposure of the worker.

15.17 If an employee is likely to receive a radiation dose greater than three-tenths of a relevant dose limit in a year (6 mSv in the case of whole-body exposure) IRR99 regulation 20 requires the employer to designate that employee as a classified person. For non-classified employees reference 39 provides guidance on the arrangements which licensees should be put in place to restrict exposure. Guidance for licensees is also provided in reference 39 on the arrangements for entry into controlled areas by members of the public or employees who do not normally work with ionising radiation.

15.18 For classified employees the employer has to arrange for any significant doses (internal or external) received by that person to be assessed by a dosimetry service approved by HSE for the measurement and assessment of doses for the relevant type of radiation. Such services are referred to as Approved Dosimetry Services (ADS) (assessment). HSE also approves dosimetry services to co-ordinate individual doses received from different ADS (assessment) and to produce and maintain dose records for classified persons. These services are referred to as ADS (records).

SS 115: Appendix I, I.44: Employers, registrants and licensees shall maintain exposure records for each worker for whom assessment of occupational exposure is required

15.19 To help the employer assess the effectiveness of the dose control measures, the ADS (records) provides a written summary of the doses recorded for each classified employee at least once every three months. Many ADS (records) provide monthly dose summaries. By the end of March each year the ADS must also provide HSE with summaries of all recorded doses relating to classified persons for the previous year.

15.20 Reflecting concern expressed at the Public Inquiry [27] into the construction of Sizewell B, an additional licence condition (LC 18) was attached to all nuclear site licences requiring licensees to monitor the average effective dose equivalent and notify the HSE if this figure exceeds the level specified by the HSE (currently 5mSv) for any specified class of persons. The classes of persons enable differentiation between the dose received by employees and contractors and by classified and non-classified persons.

15.21 HSE has a computerised Central Index of Dose Information (CIDI) that receives and processes the annual dose summaries. All dose summaries and personal data provided to HSE by ADS (records) under IRR99 (or previously under IRR85) are treated as confidential.

Various safeguards protect the computer files and the information presented in published reports maintains that confidentiality.

SS 115: I.36: Employers shall ensure that workers who may be exposed to radioactive contamination, including workers who use protective respiratory equipment, be identified and shall arrange for appropriate monitoring to the extent necessary to demonstrate the effectiveness of the protection provided and to assess the intake of radioactive substances or the committed doses, as appropriate.

15.22 Designation of Controlled or Supervised Areas is required by IRR99 regulation 16. The main purpose of designating controlled areas is to help ensure that routine and potential exposures are effectively prevented or restricted. This is achieved by controlling who can enter or work in such areas and under what conditions. Normally, controlled areas will be designated because the employer has recognised the need for people entering the area to follow special procedures. Regulations 18 and 19 specify requirements for designated areas to ensure that, inter alia, there are appropriate arrangements for control and monitoring of radioactive contamination including contamination of workers. Such arrangements typically include monitoring of contamination where work is being carried out, and of workers at the points of egress from the local work area, and at the exits from the designated areas.

15.23 Assessment of intakes of radioactive material by workers and the resultant doses is carried out by means of air sampling, excreta sampling and analysis, and in-vivo monitoring. IRR99 include a number of regulations to ensure that appropriate steps are taken. Regulations 20 and 21 require that relevant workers are classified, and that for these workers all significant doses are assessed and recorded. A comprehensive system exists to ensure that the assessment and recording of doses for classified workers is done accurately and reliably.

15.24 IRR99 regulation 23 states that where any accident or other occurrence takes place which is likely to result in a person receiving an effective dose exceeding 6mSv or equivalent dose greater than three tenths of any dose limit the employer shall: for a classified person arrange a dose assessment with an approved dosimetry service; for an employee who has been issued with a dosemeter or other device in accordance with contingency plan requirements (IRR99 regulation 12 refers); and any other case having regard to the advice of the radiation protection advisor. The employer is expected to inform those affected as soon as possible and keep records for the durations required in IRR99 regulation 23.

SS 115: Appendix I, I.30: If workers are engaged in work that involves or could involve a source that is not under the control of their employer, the registrant or licensee responsible for the source and the employer shall co-operate by the exchange of information and otherwise as necessary to facilitate proper protective measures and safety provisions.

15.25 IRR99 regulation 15 requires employers with employees in the same workplace to co-operate with each other. The aim of the co-operation should be to co-ordinate the measures they take to comply with legal requirements and inform each other of the risks to employees arising from their work. The information shared would include matters such as information relating to controlled areas, contingency arrangements, and sharing dose information.

SS 115: Appendix I, I.21 I.24 & I.37:
1.21. Licensees shall designate as a controlled area any area in which specific protective measures or safety provisions are or could be required for:
(a) controlling normal exposures or preventing the spread of contamination during normal working conditions; and
(b) preventing or limiting the extent of potential exposures.
I.24 Licensees shall designate as a supervised area any area not already designated as a controlled area but where occupational exposure conditions need to be kept under review even though specific protection measures and safety provisions are not normally needed.
I.37 Licensees, in co-operation with employers if appropriate, shall establish, maintain and keep under review a programme for the monitoring of the workplace under the supervision, if so required by a Regulatory Authority, of a qualified expert and a radiation protection officer.

15.26 A controlled area is an area in which specific protection measures and safety provisions are or could be required for controlling normal exposures or preventing the spread of contamination during normal working conditions, and preventing or limiting the extent of potential exposures. A supervised area is an area other than a controlled area in which occupational exposure conditions are kept under review, even though specific protection measures and safety provisions are not normally needed.

15.27 Under IRR99 regulation 16 the responsibility for designating a controlled area rests with the licensee in control of that area. An assessment undertaken by the licensee will establish whether special procedures are necessary to restrict exposure. The designation of a supervised area by the licensee will depend on the assessment of doses and whether conditions may change licensee. The licensee is required under IRR99 regulation 13(1) to consult an RPA on the implementation of the requirements as to controlled and supervised areas. IRR 99 regulation 19 also requires licensees who designate controlled or supervised areas to ensure that levels of ionising radiation are adequately monitored and that those areas are kept under review. Advice is provided in reference 39 on issues for consideration and dose levels appropriate to designate a controlled or supervised area. Licensees have therefore developed arrangements to ensure the appropriate legal requirements are met and relevant good practice adopted for controlled and supervised areas.

SS 115: Appendix I, I.28: Employers, registrants and licensees shall ensure that:
(a) workers be provided with suitable and adequate personal protective equipment which meets any relevant standards or specifications,
(b) when appropriate, workers receive adequate instruction in the proper use of respiratory protective equipment, including testing for good fit;
(d) all personal protective equipment be maintained in proper condition and if appropriate be tested at regular intervals;

15.28 IRR99 regulations 9 and 10 requires licensees to ensure that workers are provided with appropriate personal protective equipment and that it is subject to routine examination and maintenance. Licensees are also required to ensure appropriate information, instruction and training is provided to workers using personal protective equipment. To meet the personal protective equipment requirements in IRR99 licensees have developed their own

arrangements to ensure compliance. The HSE checks that the requirements are met as part of its inspection programme.

Licensing requirements

15.29 In addition to the application of IRR99, the regulation of radiological hazards is also achieved through the licensing regime. Under LC 14 on safety documentation the licensee is required to submit to HSE written safety cases demonstrating that safety will be maintained during design through to the decommissioning of the installation.

15.30 The adequacy of the licensee's safety submissions, is assessed by HSE against its SAPs (see Annex 8 on fundamental principles, and Basic Safety Limits and Basic Safety Objectives). The principles relating to radiological protection are consistent with the latest recommendations in ICRP60[42]) and ensure that the licensee makes a strenuous pursuit of the objective to keep exposures ALARP.

15.31 Owing to the nature of the radiological hazard presented by large nuclear installations there is, additional to the provisions of IRR99, the requirement for licensees to make and implement adequate arrangements for the assessment of the average effective dose equivalent (including any committed effective dose equivalent) to specified classes of person (LC 18 on radiological protection). Again, enforcement of this requirement is carried out by the HSE.

Radiation Doses at Nuclear Installations

15.32 The radiation doses to personnel working at the operating UK Magnox reactors were as follows:

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003
manSv per reactor*	0.26	0.27	0.25	0.24	0.21	0.23	0.17	0.11	0.10

(*Calder Hall reactors were excluded)

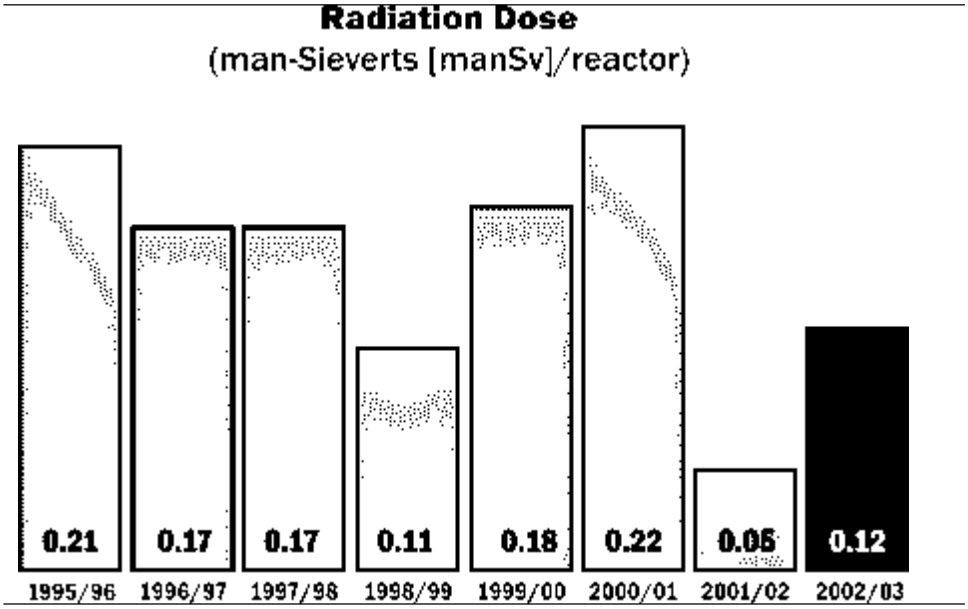
15.33 The total collective dose to all persons working at the operating Magnox reactor sites (excluding Calder Hall) during the calendar year 2003 was 1.74 man Sv with 1.05 man Sv to employees and 0.64 manSv to contractors. The Company Dose Restriction Level is 20 milliSieverts (mSv). No individual received a dose in excess of 10 mSv whist working at these sites during 2003. In addition all individuals who worked at the Magnox reactor sites in 2003 received less than 5mSv with the exception of 4 employees and 13 contractors who received doses in the range 5 to 10 mSv.

15.34 The total collective dose to all persons working on British Energy Generation sites during calendar year 2002 was 1.75 manSv with 0.52 manSv to employees and 1.23 manSv to contractors. Employees' collective doses in England were 0.32 manSv and 0.20 in Scotland, whereas contractors' doses were 0.85 manSv in England and 0.38 manSv in Scotland. Although no employee was permitted to exceed the Company Dose Restriction Level of 10 mSv whilst working on British Energy Generation sites in the UK during 2002, 12 contract staff who worked across three sites (Hunterston B, Torness and Hinkley Point B)

did exceed this Company constraint. The highest individual dose being 11.726 mSv compared against the legal limit of 20 mSv.

15.35 Record information has determined that in addition to the 12 contractors who exceeded 10 mSv, a further 46 contractors and 4 employees received exposures in a dose band between 5 and 10 mSv. The Approved Dosimetry Services provide numbers of people in dose bands that are presented separately for the each site and represent only the doses received working at those sites. Some people will have worked across many sites in both countries during the year and so combined statistics would not simply be obtained by adding the individual site figures.

British Energy: **Radiation dose** [30]



15.36 A recent change across BE (apart from Hinkley Point B and Torness) is that electronic personal dosemeters (EPDs) are now being used as the legal dosemeter (following approval from the HSE) in place of passive dosemeters to make assessments of individual radiation exposure. These have been used for some years as aids to the management and control of dose. Subject to approval the other stations will move to EPDs over the next few years.

ARTICLE 16 - EMERGENCY PREPAREDNESS

"1. Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency.

For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.

2. Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.

3. Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency."

Emergency Preparedness for a radiological emergency at a UK nuclear installation

16.1 The precautions taken in the design and construction of nuclear installations in the UK, and the high safety standards in their operation and maintenance, reduce to an extremely low level the risk of accidents that might affect the public. However, all nuclear installation operators prepare, in consultation with local authorities, the police and other bodies, emergency plans for the protection of the public and their workforce, including those for dealing with an accidental release of radioactivity. These are regularly tested in exercises under the supervision of HSE.

16.2 The Department of Trade and Industry (DTI) co-ordinates emergency preparedness policy at national level as lead government department on the UK's arrangements for response to any emergency with off-site effects from a licensed civil nuclear site in England and Wales. Consequently it chairs the Nuclear Emergency Planning Liaison Group (NEPLG), which brings together organisations with interests in off-site civil nuclear emergency planning. It is a forum for discussing common problems, exchanging information and experience and agreeing improvements in planning, procedures and organisation. It has issued guidance [43] to all those involved in the development of site-specific emergency plans at local level and reviews the results of off-site exercises to ensure lessons are learned and the process of incremental improvement continues.

16.3 In the event of an emergency at a civil nuclear site in Scotland, lead Government department responsibility and the main national coordinating role would fall to the Scottish Assembly. DTI would still be responsible for briefing the Westminster Parliament and the UK's international partners.

16.4 The UK aims to ensure it is equipped and prepared to respond to the most unlikely event of an emergency at a civil nuclear site. So in practical terms, individuals with a role if there is an emergency at a nuclear installation receive briefing and training, mostly through participation in exercises, to ensure they can cope effectively in the event of any nuclear emergency. The police, working in conjunction with other emergency services, expert bodies, and local and national agencies, would coordinate any response effort locally. DTI would co-ordinate the response at national level; it would brief Ministers and the UK's international partners, and be the main source of information at national level to the public and the media. These arrangements are exercised at regular intervals by all the organisations concerned.

16.5 In the event of a nuclear accident overseas, which may have implications for the UK, Defra would be the lead Government department and would receive initial notification through arrangements established by a series of multi-lateral or bilateral Conventions, or agreements. In addition, Defra operates the UK's Radioactive Incident Monitoring Network (RIMNET) of continuous radiation monitoring stations, which would automatically raise an alarm if abnormal increases in the levels of radiation were detected at any of the sites. RIMNET would be used to collect, collate and disseminate radiation monitoring data from a wide number of sources and would be used as a basis for any necessary public protection measures.

GS-R-2 3.8: The regulatory body shall require that arrangements for preparedness and response be in place for the on-site area for any practice or source that could necessitate an emergency intervention. Arrangements shall be established from the time that nuclear fuel [or significant amounts of radioactive or fissile material] is brought to the site, and complete emergency preparedness as described here shall be ensured before the commencement of operation. The regulatory body shall ensure that such emergency arrangements are integrated with those of other response organizations as appropriate before the commencement of operation. The regulatory body shall ensure that such emergency arrangements provide a reasonable assurance of an effective response in the case of a nuclear or radiological emergency. The regulatory body shall require that the emergency arrangements shall be tested in an exercise before the commencement of operation. There shall thereafter at suitable intervals be exercises of the emergency arrangements, some of which shall be witnessed by the regulatory body.

16.6 LC 11 (see Annex 5), on emergency arrangements, is to ensure that the licensee has adequate arrangements in place to respond effectively to any incident ranging from a minor on-site event to a significant release of radioactive material. The Condition requires employees to be properly trained and that the emergency arrangements are exercised. There is also a requirement for the licensee to consult with any person not in their employ who may be required to participate in emergency arrangements. The licensee submits to HSE for approval such parts of the arrangements as HSE may specify. Once approved by HSE no alteration or amendment can be made to the approved arrangements unless HSE has approved the alteration or amendment.

16.7 LC 11 requires rehearsal of the arrangements to ensure their effectiveness. This is achieved by the licensee holding training exercises and HSE agreeing to a programme of demonstration emergency exercises that HSE nuclear installations inspectors formally observe. HSE can specify that exercises cover all or part of the arrangements. This power

would be used if HSE is not satisfied with an aspect of the licensee's performance and the licensee did no agree or volunteer to repeat the exercise.

16.8 HSE consent is required to bring nuclear fuel onto a site for the first time. As part of the assurances that HSE requires prior to granting this Consent, the establishment of appropriate emergency and evacuation arrangements have to be demonstrated including the approval of an Emergency Plan that is in the public domain and cannot be changed without the approval of HSE. The relevant considerations are that there are sufficient trained personnel and suitable available equipment to deal with the risks from hazards on the site. Similarly, the consent of HSE is required at stages specified by HSE relating to key increases in hazard on the site in the process of bringing the plant from initial criticality to achievement of full reactor rating. At any of these stages, HSE may require a demonstration of enhanced emergency arrangements prior to the granting of Consent to proceed to the next stage. This demonstration may be by training records for all staff affected or a demonstration exercise against a testing scenario. Throughout the life of the nuclear installation, the emergency arrangements are subject to review and, with HSE's approval as described above, revision as appropriate. A part of the licensees training arrangements include all staff participating in a regular programme of emergency exercises, which requires each shift at each nuclear site to exercise the arrangements at least once a year.

GS-R-2 5.31: The operator and the response organizations shall make arrangements for the selection of personnel and for training to ensure that the personnel have the requisite knowledge, skills, abilities, equipment, and procedures and other arrangements to perform their assigned response in [emergency plans]. The arrangements shall include ongoing refresher training on an appropriate schedule and arrangements for ensuring that personnel assigned to positions with responsibilities for emergency response undergo the specified training.
GS-R-2 5.35: The officials off the site responsible for making decisions on protective actions for the population … shall be trained in the strategy for protective action and shall regularly participate in exercises.

16.9 The requirements for the preparation and testing off-site emergency plans are covered by REPPIR [18] and are regulated by HSE. REPPIR requires off-site plans to be produced by the local authority in consultation with emergency responders for those sites where a radiation emergency is considered to be reasonably foreseeable. The responsibilities for reviewing and testing off-site emergency plans are also covered in REPPIR. Where there is the potential for an offsite release of radioactivity that would require implementation of countermeasures detailed emergency planning zones are provided around nuclear installations. These zones are defined based on the most significant release of radiation from an accident, which can be reasonably foreseen. In the event of an accident being larger than the reasonably foreseeable event there are arrangements for extending the detailed emergency-planning zone.

16.10 The prime function of the off-site facility is to: decide on the actions to be taken off-site to protect the public, to ensure that those actions are implemented effectively and to ensure that authoritative information and advice on these issues is passed to the public (the facility includes media briefing centres). Decisions would generally be made through regular coordinating group meetings. These are usually chaired by the Police, who are responsible for taking decisions to protect the public, and would involve all the principal organisations

represented at the facility.

16.11 The declaration of a nuclear emergency at a Site would be followed immediately by the notification of the emergency services and local and national authorities. Each organisation with responsibilities for dealing with the emergency would be represented at the off-site facility. These would generally include the Operator, the Police, the Local Authority, the Health Authority, Local Water Company and the Fire and Ambulance services. In addition Government Departments and Agencies would also be represented. These would include Defra, (or Scottish or Welsh equivalents), the DTI, NRPB and the HSE. As the regulators for disposal of radioactive waste, SEPA in Scotland, and EA in England and Wales, would also be represented, as would the Food Standards Agency to issue advice and restrictions (if it feels it necessary) on fresh food in the area of the emergency. The representatives would provide links with their organisations and be responsible for ensuring that adequate information and advice were available both at the off-site and at the emergency control centres of their respective organisations. The representatives would liaise closely to ensure that a proper assessment was being made of the situation, that appropriate actions were being taken and that the public was being kept informed. The following Figures 16.1 to 16.3 show the arrangements diagramatically.

16.12 The technical information regarding plant prognosis and radiological assessments by the Operator is an important aspect in the response to an emergency. The off-site facility will receive this information from the Operator's organisation. The Operator's representatives at the facility will have a prime function in ensuring that adequate information is available to those at the facility and to ensure that their own organisations are aware of what assistance the facility requires.

16.13 Emergency arrangements are tested regularly under three categories known as level 1, level 2 and level 3. Level 1 exercises are held at each nuclear installation site once a year and concentrate primarily on the operator’s actions on and off the site. Level 2 exercises are aimed primarily at demonstrating the adequacy of the arrangements that have been made by the local authority to deal with the off-site aspects of the emergency, particularly the functioning of the Off-Site Facility [OSF] where organisations with responsibilities or duties at the OSF also exercise their functions.

16.14 From the annual programme of level 2 exercises one is chosen as a level 3 to rehearse not only the functioning of the OSF but also the wider involvement of central government, including the exercising of the various government departments and agencies attending the Nuclear Emergency Briefing Room [England and Wales] in London or the Scottish Executive Emergency Room in Edinburgh. The decision on which exercise should be selected as the level 3 is made jointly between the licensees, the lead government departments [DTI or the Scottish Executive] and NEPLG in consultation with HSE.

Figure 16.1: Emergency Centres

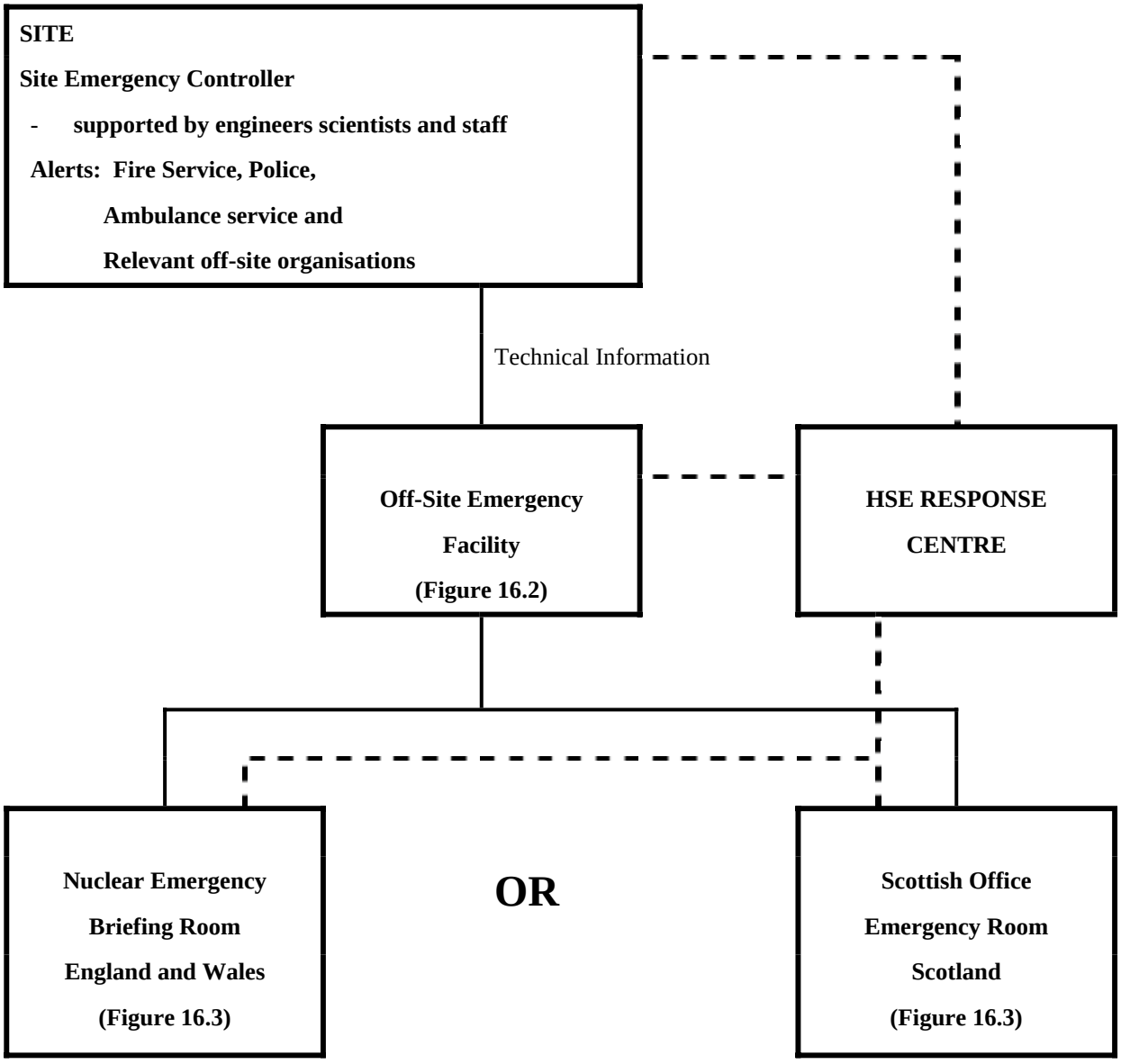


Figure 16.2: Off-Site Facility Representatives

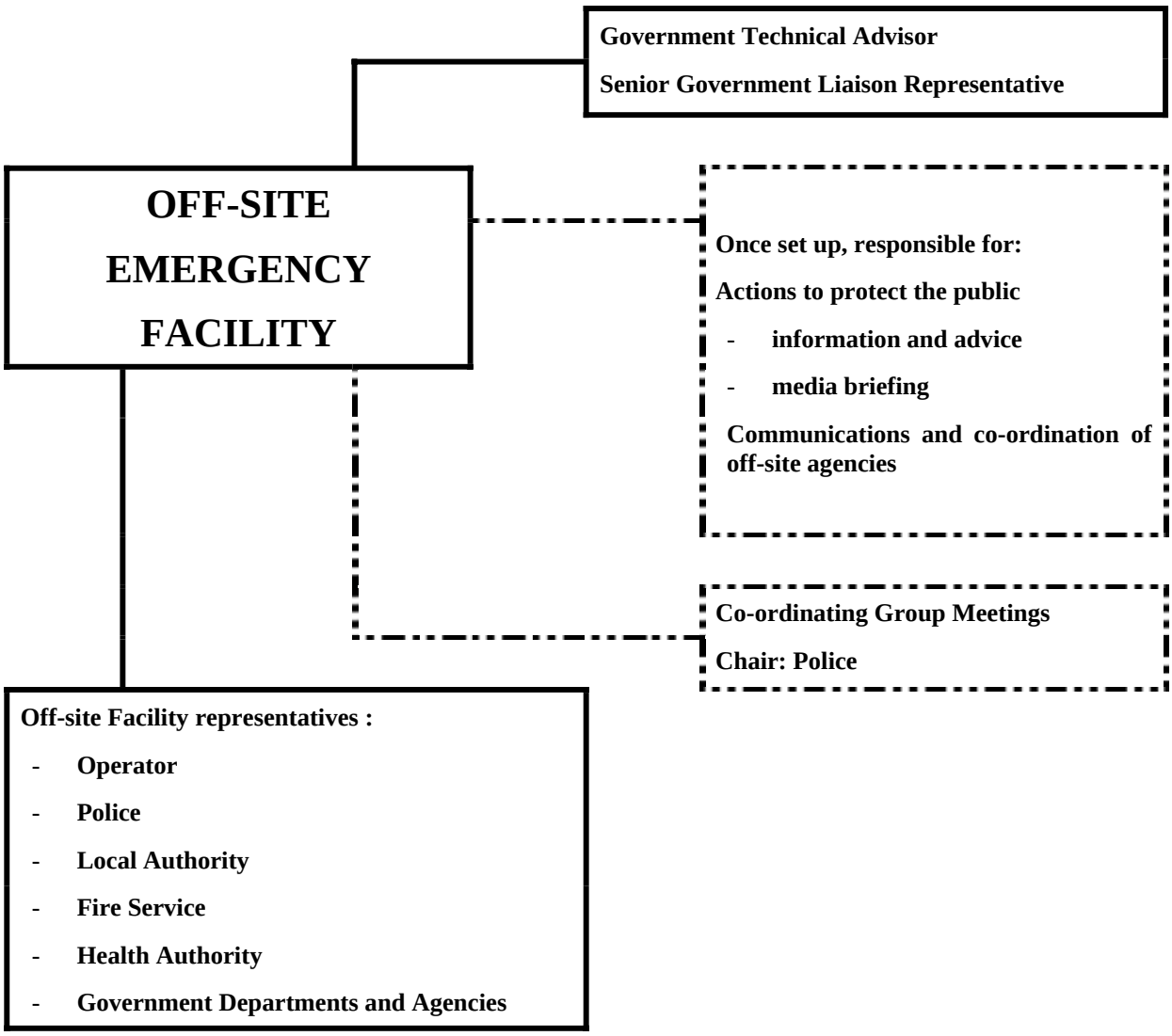
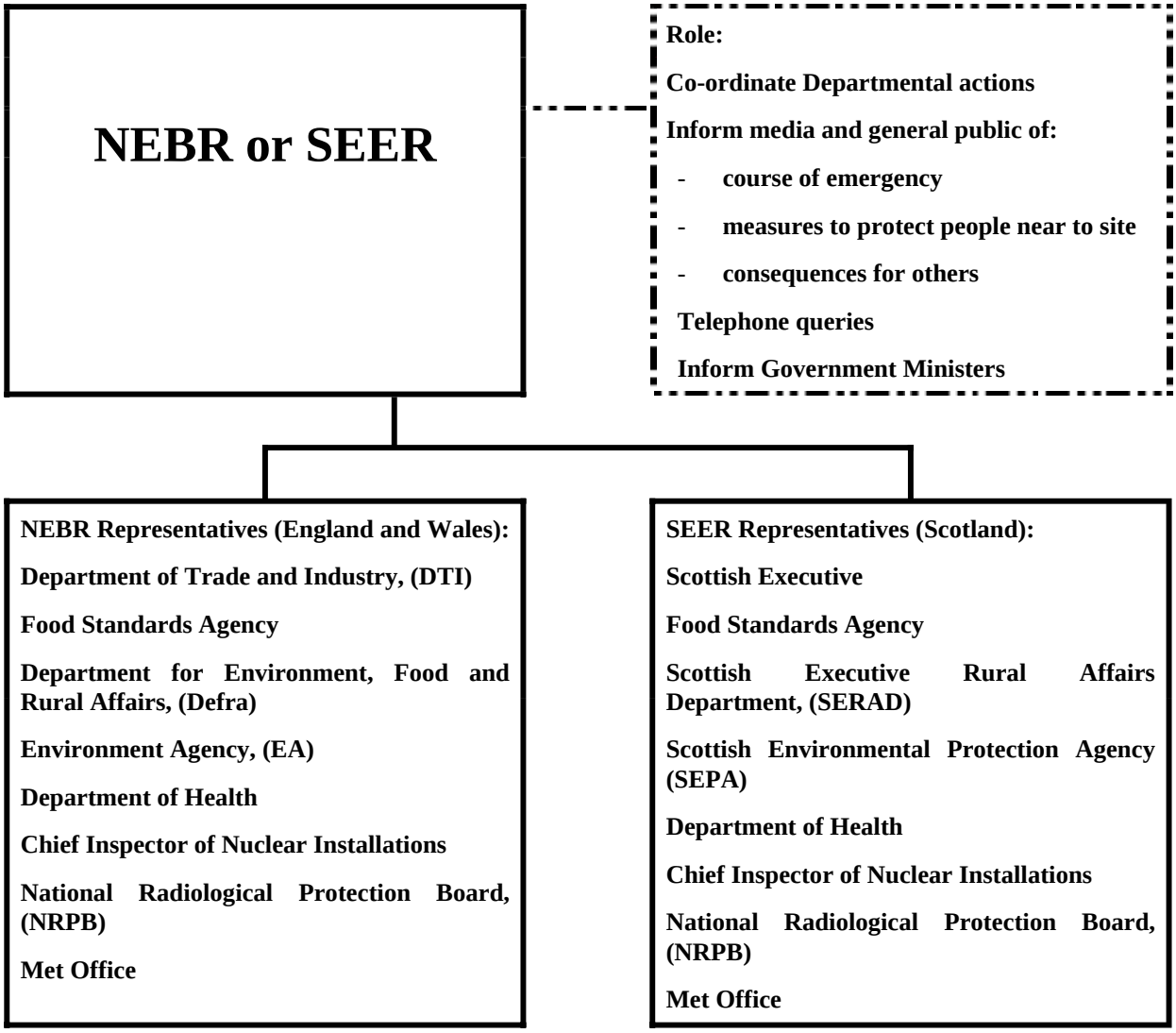


Figure 16.3: Nuclear Emergency Briefing Room (NEBR) and Scottish Executive Emergency Room representation (SEER)



SS 115: V.3: The appropriate responsible authorities shall ensure that (f) prior information is provided to members of the public who could reasonably be expected to be affected by an accident?
GS-R-2 5.12: Arrangements shall be made to ensure that all States within defined emergency zones are provided with appropriate information for developing their own preparedness to respond to an emergency and arrangements shall be made for appropriate transboundary co-ordination. These arrangements shall include: agreements and protocols to provide information necessary to develop a coordinated means for notification, classification schemes, intervention criteria and criteria for the introduction and revoking of protective actions; arrangements for public information; and arrangements for the exchange of information between decision making authorities. The language and physical units to be used shall be determined in advance. Pending the establishment of such agreements and protocols, due care shall be exercised in relations between States so as to minimize the consequences of any nuclear or radiological emergency.

Public information

16.15 REPPIR provides a legal basis for the supply of information to members of the public who may be affected by a nuclear emergency. The requirements are placed on the operator and the relevant local authorities. In addition, the various information services of the local agencies involved and of central government, together with the news media, are available to help in informing the public of the facts and of the assessments being made of the course of the accident, should one occur.

16.16 REPPIR requires that members of the public within or close to a detailed emergency planning zone who could be at risk from a reasonably foreseeable radiation emergency should receive certain prescribed information. Such information must be distributed in advance of any emergency occurring. Site operators provide such information in a variety of forms, which is updated at regular intervals not exceeding three years. The operator also makes the information available to the wider public, usually by providing information on request or by placing copies in public buildings such as libraries and civic centres. Every nuclear installation licensee also has local liaison arrangements that provide links with the public in the vicinity of the site.

Information in the event of an emergency

16.17 REPPIR requires local authorities to prepare and keep up-to-date arrangements that ensure that members of the public actually affected by a nuclear emergency receive prompt and appropriate information. The operator would also be expected to make a formal announcement as soon as possible after the emergency had been declared. While the agencies involved in responding to the emergency would seek to deal with any queries they received, the main channel of communication with the public outside the immediate vicinity of the affected site would be the media.

16.18 The duration and extent of an emergency would depend on the scale and nature of the radioactive release. Once the release had been terminated, ground contamination would be checked and the police would advise those who had been evacuated when they could return home. At about this stage the emergency condition would be officially terminated, but the return to completely normal conditions might take place over a period of time.

16.19 For an emergency at a nuclear installation in the UK the DTI would take the responsibility for notifying other countries and initiate requests for international assistance. Under existing early notification conventions, the DTI would inform the European Community, the IAEA, and countries with which the UK has bilateral agreemants and arrangements, about the accident and its likely course and effects.

16.20 The UK regularly takes part in emergency exercises with other countries to test emergency arrangements should there be a nuclear emergency in another country that has the potential to affect the UK.

SS 115: V.7: Off-site emergency plans shall be implemented by the Intervening Organisation.
GS-R-2 4.14: Appropriate emergency response actions shall be initiated promptly upon the receipt of a notification from another State or information from the IAEA of a notification relating to an actual or potential transnational emergency that could affect the State or its nationals.

16.21 Defra is the lead Government department for coordinating the response to an overseas nuclear emergency. The UK has signed a number of international agreements covering exchange of information in the event of a nuclear emergency. Defra is the contact point for inward notifications under these arrangements. The National Response Plan, implemented by Defra with support from EA provides arrangements for dealing with an emergency. This includes Defra maintaining contact arrangements and duty officers that ensure the UK can be notified of an emergency at any time. The RIMNET network operated by Defra, comprising 92 gamma dose rate monitors located throughout the UK and provides a secondary alert mechanism in the event of non-notification. RIMNET is the UK's national radiological database. Defra has established procedures including the notification and alert of organisations within the UK with responsibilities for dealing with an overseas nuclear accident. It maintains the Technical Co-ordination Centre and Information Centre within the Defra headquarters building in London, containing the equipment required for management of the response.

16.22 More detailed information on the UK's emergency arrangements for nuclear installations can be found at Annex 9.

ARTICLE 17 - SITING

"Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:

(i) for evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime;

(ii) for evaluating the likely safety impact of a proposed nuclear installation on individuals, society and the environment;

(iii) for re-evaluating as necessary all relevant factors referred to in sub-paragraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation;

(iv) for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation."

17.1 In the UK no new nuclear installation sites have been considered since the Sizewell B and Hinkley Point C Public Inquiries [27,28] in the 1980s. Therefore the UK has no recent experiences of site evaluation and selection. However the UK recognises that processes and procedures will need to be in place should there be a future decision to build new nuclear installations. Such processes and procedures would be based on the prevailing current national planning and licensing requirements together with international requirements and obligations. The UK response to Article 17 is therefore largely historic but it also recognises that the framework exists for the continuing re-evaluation to ensure the acceptability of the existing nuclear installations.

17(i) Evaluation of site-related factors likely to effect the safety of a nuclear installation during its lifetime

National Laws, Regulations for Planning and Licensing Process

17.2 An organisation wishing to construct, extend or operate any type of power generating station in the UK must first obtain planning permission from the relevant local authority under the Town and Country Planning Act (1990) (TCP Act) [44]. This includes the site-related factors relevant to the safety of the proposed nuclear installation.

17.3 For proposals for stations exceeding 50 megawatts, organisations must also obtain a consent under Section 36 of the Electricity Act 1989 (see paragraph 7.8) from the Secretary of State for Trade and Industry for stations in England and Wales, the Secretary of State for

Scotland for stations in Scotland or, in the case of stations in Northern Ireland, the Secretary of State for Northern Ireland. Before granting a "Section 36" consent, the relevant Secretary of State must consult the relevant planning authority. If that authority objects to the proposed development and those objections are not subsequently addressed and the proposal modified accordingly, a public inquiry must be held. Public Inquiries may consider all factors relating to the proposal. Where the relevant planning authority does not object to the proposal, the relevant Secretary of State may, in any case, choose to hold a public inquiry if he or she considers this to be appropriate in the light of other objections and considerations. In the case of a nuclear installation, while a public inquiry is not legally obligatory, given the inevitable objections that will arise, one would be held.

17.4 Under the Electricity Act, the relevant Secretary of State has the power, having consulted the relevant local authority and following any public inquiry which might have been required, to direct that a Section 36 consent means that planning permission under the TCP Act has also been granted.

17.5 Proposals for nuclear power stations and also for non-nuclear stations with a heat output of over 300 megawatts must be accompanied by an assessment of the environmental impact of the proposed development for consideration by the relevant Secretary of State.

17.6 For Scotland, the Town and Country Planning (Scotland) Act 1997 [45] provides a comparable planning framework for the consideration of the siting of a nuclear installation to that for England and Wales in the TCP Act and the Secretary of State for Scotland has similar powers to direct that a public inquiry be held.

17.7 In addition to the above, under the NIA65 section 1(1) (see Annex 4) no corporate body can use any site for a nuclear installation unless a nuclear site licence has been granted in respect of that site by the HSE and is for the time being in force. The licensing process includes a safety evaluation of the proposed reactor design. Also, under section 4(1) of the NIA65, on granting any nuclear site licence HSE can attach such conditions as may appear to HSE necessary or desirable in the interests of safety. The Licence Conditions (LCs, see Annex 5) include provisions with respect to siting. In particular, LC 2 requires the licensee to mark the boundaries of the nuclear licensed site. Section 6(1) of the NIA65 requires the Minister to maintain a list showing every site for which a nuclear site licence has been granted and including a map or maps showing the position and limits of each such site.

Government Siting Policy

NS-R-3, 2.19: The size of the region to which a method for establishing the hazards associated with major external phenomena is to be applied shall be large enough to include all the features and areas that could be of significance in the determination of the natural and human induced phenomena under consideration and for the characteristics of the event.

17.8 Government policy on siting nuclear installations reactors has developed over time. The White Paper 'A programme of nuclear power' (1955) section 37 stated that '... the first stations, even though they will be of an inherently safe design, will not be built in heavily

built-up areas.' A definition of a remote site, based on characteristics of the early sites, was used for all subsequent steel vesseled Magnox reactors.

17.9 The Government's siting criteria were developed in 1955 included the following:

- Only a few people should be subject to extreme risk: plans should be prepared for affecting the urgent evacuation of persons close to the site in the downwind direction;
- Protracted evacuation or severe restriction on normal living should not be imposed on any but small population centres; and
- Temporary evacuation or restrictions should not be necessary for more than 10,000 people in any but exceptional weather conditions. If an accident were to coincide with exceptional weather conditions, not more than 100,000 persons should ultimately be affected.

17.10 On 6 February 1968 the Minister of Power stated that as a result of advances in technology the safety of a gas-cooled reactor in a concrete pressure vessel was such that it may be constructed and operated much nearer built-up areas than had so far been permitted. The Minister commented that there were advantages in having these stations near centres of population in terms of amenity and of transmission costs.

17.11 The Minister of Technology on 23 March 1970 stated that before a site is accepted for a nuclear power station, account is taken of all known development plans. This ensures that projected developments in the vicinity of the station are not hampered.

17.12 On 5 December 1973 the Secretary of State for Trade and Industry stated that first of a kind reactors, if licensable, would be built on sites similar to those used for early Magnox reactors, i.e. remote sites, and relaxation to sites nearer centres of population would depend on relevant experience.

17.13 The Secretary of State for Energy on 11 March 1988 tabled the demographic criteria for assessing potential sites, both for Magnox reactors and AGRs. Magnox reactors in concrete pressure vessels would be allowed some relaxation of the general Magnox criteria if necessary.

NS-R-3, 2.21: In the determination of hazards, site specific data shall be used, unless such data are unobtainable.

17.14 When siting nuclear installations, account was taken of natural and man-made hazards in the area. This was an essential part of the design safety report on which initial licensing was based.

NS-R-3:

- **The hazards associated with earthquakes shall be determined, paragraphs 3.1-3.4**
- **The potential for surface faulting shall be assessed, paragraphs 3.5-3.7**
- **Meteorological events, including extreme values, shall be investigated, paragraphs 3.8-3.10**
- **The frequency and severity of lightning shall be evaluated, paragraph 3.11**
- **The potential for tornadoes shall be assessed, paragraphs 3.12-3.14**
- **The potential for tropical cyclones shall be evaluated, paragraphs 3.15-3.17**
- **The region shall be assessed to determine the potential for flooding due to precipitation and other causes, paragraphs 3.18-3.23**
- **The region shall be evaluated to determine the potential for tsunamis or seiches, paragraphs 3.24-3.28**
- **Information relating to upstream water control structures shall be analysed, paragraphs 3.29-3.32**
- **The site and its vicinity shall be evaluated to determine the potential for slope instability, paragraph 3.33**
- **The potential for collapse, subsidence or uplift of the site surface, shall be evaluated, paragraph 3.35-3.37**
- **The potential for liquefaction of the surface materials of the proposed site shall be evaluated, paragraphs 3.38-3.40**
- **The geotechnical characteristics of the subsurface material shall be investigated, paragraphs 3.41-3.43**
- **The potential for aircraft crashes on the site shall be assessed, paragraph 3.44.**
- **Activities in the region that involve chemicals having a potential for explosions, deflagration or detonation shall be identified, paragraphs 3.48-3.49**

17.15 HSE's SAPs set out guidance on what should be addressed during the design of a new nuclear installation, this includes criteria for site-specific data. SAPs P119 – P143 address site-specific hazards. Earthquakes, flooding, drought, high winds and extremes of ambient temperature are examples of natural hazards that need to be considered. Man-made hazards include the possibility of an aircraft crash on the site and the storage, processing or transport of hazardous materials in the vicinity. The hazard analysis should be used in the plant design and where appropriate, in the operation of the plant.

NS-R-3, 3.51: The region shall be investigated for installations (including installations within the site boundary) in which flammable, explosive, asphyxiant, toxic, corrosive or radioactive materials are stored, processed, transported and otherwise dealt with that, if released under normal or accident conditions, could jeopardize the safety of the installation.

17.16 Under REPPIR [18] and COMAH [46] the relevant local authority is required to prepare a written off-site emergency plan that brings together the emergency arrangements of all hazardous installations in the area. HSE determines the area of the emergency planning zone.

NS-R-3, 3.54: Potential natural and human induced events that could cause a loss of function of systems required for the long term removal of heat from the core shall be identified.

17.17 The identification of potential natural and human induced events that could cause a loss of long-term heat removal will be addressed in the Pre- Construction Safety Report (PCSR). This is a requirement of the NII Safety Assessment Principles (SAPs) and the Licensees Design Safety Guidelines. The licensee has to demonstrate to HSE's satisfaction that it has identified all the relevant events for the site in question.

17(ii) Criteria for Determining the Potential Effects of the Nuclear Facility on Individuals Society and Environment

NS-R-3, 2.22: In the evaluation of a site to determine its potential radiological impact on the region for operational states and accident conditions that could lead to emergency measures, appropriate estimates shall be made of expected or potential releases of radioactive material, with account taken of the design of the installation and its safety features. These estimates shall be confirmed when the design and its safety features have been confirmed.

17.18 The initial design of a nuclear power plant will minimise the radiation exposure to the workers and general public. This will be addressed in the PCSR. HSE SAPs [26] P6 –P11 set out guidelines for radiation exposure during normal operation. The safety case prepared by the licensee has to convince HSE that these guidelines will be met. As the nuclear installation design develops, so too the safety case must become more developed and provide the necessary verification of the initial calculations. The Pre-Operational Safety Report will take into account all the commissioning tests and the validation of any initial assumptions. This will be reviewed during the course of the plant's life in the Periodic Safety Reviews (PSRs)

NS-R-3, 2.23: The direct and indirect pathways by which radioactive material released from the nuclear installation could potentially reach and affect people and the environment shall be identified and evaluated; in such an evaluation specific regional and site characteristics shall be taken into account.

17.19 The SAPs P60 and P58 and the licensees' Design Safety Guidelines require the consideration of the topography and geology for the area that might effect the dispersion of the authorised radioactivity discharged from the site in normal operation or release in the event of an accident. In addition, aspects of the topography of the area around the site that may affect the movement of people and goods are identified and their effect on the safety of the plant examined. This examination determines whether the topography and road and rail systems are such as to create difficulties if it became necessary to evacuate people from the area around the plant.

17.20 SAP P58 addresses the dispersion of radioactive releases via the atmosphere, surface water and ground water and the potential exposure pathways. The SAP requires modelling to be done with "established and well-researched models". In the event of a new build programme, the details would need to be agreed between regulator and licensee before the model could be used.

17.21 HSE SAPs also require a full evaluation of the design basis accident together with its

radiological consequences (see Article 18) and a deterministic evaluation of severe accidents that are beyond the design basis.

NS-R-3, 2.24: The site and the design for the nuclear installation shall be examined in conjunction to ensure that the radiological risk to the public and the environment associated with radioactive releases is acceptably low.

17.22 The licensee's Design Safety Guidelines ensure that both plant design data and the site location are used to evaluate the radiological risk to the general public. However, in accident conditions, mitigation of radiological consequences will depend on effective emergency arrangements (see Article 16). This is dependant upon how many people might be involved and how the appropriate counter measures, in particular the distribution of stable iodine and evacuation might be introduced. Key factors are the population distribution and access facilities in the area. For new nuclear installation sites, the licensee submits to HSE details of present and predicted population around the site out to 30 km. Information on nearby schools, industry, hospitals, institutions and other places where people may congregate is included. HSE will assess this information against its criteria, defined in the SAPs.

17.23 On 11 March 1988 the Secretary of State for Energy stated that once a site has been accepted for a nuclear station, arrangements are to be made to ensure that residential and industrial developments are so controlled that the general characteristics of the site is preserved.

NS-R-3, 2.26: The proposed region shall be studied to evaluate the present and foreseeable future characteristics and the distribution of the population of the region. Such a study shall include the evaluation of present and future uses of land and water in the region and account shall be taken of any special characteristics that may affect the potential consequences of radioactive releases for individuals and the population as a whole.

17.24 The planning and public enquiry process (paragraphs 17.2 – 17.7) require that the all relevant issues are addressed and discussed. The process also facilitates inputs from the public and interested groups. HSE must be satisfied that the size, nature and distribution of the population around the site are properly taken into consideration. If planning permission is granted for the site there will be planning controls to ensure that significant and unacceptable population growth does not occur. In the UK the area requiring these restrictive controls varies from 3 to 3.5 km for the older plants to 1 km for modern stations (the rationale for this is addressed in Article 16).

NS-R-3: 4.1- 4.2: A meteorological description of the region shall be developed. … A programme for meteorological measurements shall be prepared and carried out at or near the site …

17.25 At the design stage of the existing nuclear installations in the UK models describing the metrological conditions in the region of the installations were developed. Since that time measurements have been taken to further develop these models against the data generated by readings taken in the vicinity of the site.

NS-R-3, 4.3: On the basis of the data obtained from the investigation of the region, the atmospheric dispersion of radioactive material released shall be assessed with the use of appropriate models.

17.26 The meteorological modelling has been used to produce bounding conditions for dispersion to be used in emergency arrangements. If an accident occurred readings would be taken of the release at both fixed measuring points and by mobile measuring facilities.

NS-R-3, 4.4-4.6: Describe how a description of the surface hydrological characteristics of the region is developed and assessed.

17.27 The UK's nuclear installation operators and environment agencies have developed models of the hydrological characteristics around existing nuclear installations.

NS-R-3, 4.7-4.9: A description of the surface hydrological characteristics of the region shall be developed. … A programme of investigation and measurements of the surface hydrology shall be carried out. … An assessment of the potential impact of the contamination of groundwater on the population shall be performed.

17.28 The UK's nuclear installation operators and environment agencies have developed models of the groundwater hydrology including information from bore holes drilled in the vicinity of the site and other information available on the rock formations under and around the nuclear licensed sites.

NS-R-3, 4.15: How has the ambient radioactivity in the region assessed before commissioning of the nuclear facility so as to be able to be determine the effects of the facility and hence provide a baseline in future investigations?

17.29 Measurements of ambient radioactivity were taken in the regions of the nuclear installations prior to radioactive material being introduced onto the nuclear licensed sites.

NS-R-3, 2.25: The design of the installation shall be such as to compensate for any unacceptable potential effects of the nuclear installation on the region, or otherwise the site shall be deemed unsuitable.

17.30 These issues were resolved during the planning processes, the licensing processes and the discharge authorisation processes of the UK's existing nuclear installations.

17.31 The potential licensees make simultaneous applications for planning consent and for a nuclear site licence. The licensing process is therefore concurrent with a Public Inquiry. HSE will discuss siting issues raised during this process with the potential licensee to ensure that the plant design is changed to address all safety issues. Should siting issues (or any other safety issue) not be resolved, HSE has the power to withhold the issue of a nuclear site licence. However, HSE would not grant a licence in advance of a 'Section 36' decision by the Secretary of State (see paragraph 17.3). Regardless of the licensing issues, the public enquiry may also conclude that the site is unsuitable for other planning reasons.

17(iii): Re-evaluation of relevant Safety Factors to ensure continued safety acceptability.

NS-R-3, 5.1: The characteristics of the natural and human induced hazards as well as the demographic, meteorological and hydrological conditions of relevance to the nuclear installation shall be monitored over the lifetime of the nuclear installation.

17.32 Continued re-evaluation of external hazards and of the emergency plans is required under LCs 15 and 11 respectively. Guidance on re-evaluation of the specific demographic requirements on siting is given to HSE nuclear installation inspectors in the SAPs. LC 15 also requires periodic safety review of all safety documentation to ensure that the plant design still meets its original intent and that all reasonably practicable safety improvements are implemented (see Article 6). This includes the re-evaluation of external hazards.

17.33 Local authorities consult the HSE with regard to any proposed development that might lead to an increase in population close to the site and on large developments further from the site. Limiting criteria based upon population distribution are used only for guidance and the HSE cannot necessarily insist on rigid adherence to them.

17.34 A joint circular to local authorities from the Department of the Environment (11/1992/84) and the Welsh Office (11/1992/WO) and a similar circular from the Scottish Development Department (5/1993) gave advice on the exercise of planning control over hazardous development and over development in the vicinity of hazardous installations.

17.35 Appendix 2 of the circular gives guidelines for the types of development in the vicinity of hazardous installations on which HSE should be consulted. These circulars established HSE as a statutory consultee for development in the vicinity of hazardous installations covered by the Regulations for Control of Development (Hazardous Installations) [47]. HSE has non-statutory arrangements, operated under the same administrative arrangements, to be consulted by local authorities in the case of planning applications in the vicinity of all nuclear installations. HSE's nuclear installation inspectors assess such planning applications to determine:

- whether a proposed development would raise the population to near the maximum guidelines set out in the Government's siting policy for nuclear installations;
- whether the external hazards in the nuclear safety case envelope the hazard from a proposed hazardous installation, or alternatively whether the nuclear safety case can be modified to incorporate the new hazard;
- for a proposed development within the nuclear licensed site, whether the licensee has made a satisfactory safety case for the proposed development and for any existing licensable activities on the site that it would impinge upon, and whether the proposed activity is suitable for a nuclear licensed site; and
- for a proposed development within the detailed emergency planning zone (where applicable), HSE refers the application to the licensee, who must in turn liase with those bodies having responsibilities under the off-site emergency plan, to find:
    - whether the development can be incorporated into the emergency plan; or failing that,

- whether the emergency plan could be modified such that the development could be incorporated into the emergency plan.

17.36 Local authorities are not obliged to, but normally follow HSE's advice. HSE can appeal to the Secretary of State for Environment, Food and Rural Affairs if a local authority does not accept HSE's advice.

NS-R-3, 3.52: Historical data concerning phenomena that have the potential to give rise to adverse effects on the safety of the nuclear installation … shall be collected and assessed.

17.37 Both the licensee and the regulator monitor and assess any phenomena (for example something that may change the assumptions concering external hazards) around nuclear site that may effect safety. This is done as part of the normal regulatory process and during the Periodic Safety Reviews. In addition, HSE maintains a database of the estimated population around nuclear installations based upon the most recent ten-yearly population census, updated to take account of subsequent planning applications for residential developments. This database is used to compare the projected population following a proposed residential development with government demographic guidelines before HSE advises a local authority on the acceptability of such a planning application.

NS-R-3, 2.27: In relation to the characteristics and distribution of the population, the combined effects of the site and the installation shall be such that:
(a) For operational states of the installation the radiological exposure of the population remains as low as reasonably achievable;
(b) The radiological risk to the population associated with accident conditions, including those that could lead to emergency measures being taken, is acceptably low.

17.38 Discharge Authorisations are reviewed regularly involving consideration of the level of actual discharges and the margin between discharges and limits. Against a background of Government policy that limits should reflect closely actual discharges, the environment agencies may decide to vary authorisations following a review, to set more stringent limits and conditions and to require improvement programmes to be instituted.

17.39 The periodic safety reviews described under Article 6 include requirements that the radiological risk from the nuclear installation under consideration will remain acceptable during the period covered by the reviews.

17(iv): Consulting Contracting Parties in the vicinity of a proposed nuclear installation,

17.40 In the case of an application to the Secretary of State for Trade and Industry for a Section 36 consent for a new nuclear power station, the UK Government will send a copy of the application to the Directorate General for Energy of the European Commission. The Commission will make the application known to other Member States through the Official Journal of the European Communities. Once a public inquiry is called, evidence may be submitted to the inquiry by anyone from any country.

ARTICLE 18. DESIGN AND CONSTRUCTION

"**Each Contracting Party shall take the appropriate steps to ensure that:**

(i) the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defence in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;

(ii) the technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;

(iii) the design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface."

18.1 In the UK no new nuclear power plants are planned or have been constructed since Sizewell B in the 1980s. However, the licensing system in the UK will ensure that, should there be a future decision to build new nuclear installations, they will be be properly designed and constructed. The UK response to Article 18 is therefore largely historic, but it demonstrates that the framework exists for the development of appropriate detailed design procedures should they be required in the future. The structure of the response is based around what the UK believes are the more significant requirements in the IAEA safety standards NS-R-1 and S-R-1.

NS-R-1 3.1: The design organization shall ensure that the installation is designed to … take account of the current state of the art for safety.

18.2 For the reason given in paragraph 18.1, no design organisation for new nuclear installations is currently active. However, as described under Article 9, the responsibility for safety rests with the licensee and it is the licensee who HSE hold responsible for design safety and the management of the design and construction process. For existing installations, each licensee recognises that the design safety criteria in place at the time of the original design and construction of its current plant do not necessarily fully meet modern standards and expectations. Guidance was therefore prepared for designers and assessors on the nuclear safety principles to be used in the review of existing designs of nuclear installations and the preparation of proposals to modify them. These principles address the reasonable practicability of achieving improvements in existing plant safety performance.

NS-R-1 3.1: The design organization shall ensure that the installation is in accordance with the design specifications and safety analysis.
The design organization shall ensure that the installation is … in accordance with the design specifications and safety analysis.

18.3 The issue of a site licence depends on the submission of an acceptable safety case for the plant. Subsequent design and construction changes are controlled by LCs 19 and 20 (see

Annex 5) attached to the nuclear site licence. LC 19 required the operator to make and implement "adequate arrangements to control the construction or installation" of a new plant.

18.4 In carrying out its control and regulatory function, HSE satisfies itself that the licensee applies the highest practicable standards in the fabrication and inspection of new nuclear plant available at the time. The HSE Safety Assessment Principles (SAPs) [26] set out the framework for safe design of a new plant. These principles are the basis of the licensee's design criteria and standards – the Design Safety Guidlines.

NS-R-1 3.1: The design organization shall ensure that … the safety of any design change is properly considered.

18.5 Under LC 20, the licensee makes and implements arrangements for modification to the design of the plant during the period of construction. Modifications are, where appropriate, divided into stages and the HSE specifies stage consents are sought before proceeding beyond that stage in the modification.

NS-R-1 3.1: The design organization shall:
(2) ensure that it has sufficient technically qualified and appropriately trained staff at all levels;
(3) establish clear interfaces between the groups engaged in different parts of the design, and between designers, utilities, suppliers, constructors and contractors as appropriate;
(5) review, monitor and audit all safety related design matters on a regular basis.

18.6 These questions are not specifically relevant to the current situation in the UK where no new designs of nuclear installations are being prepared.

18.7 However the UK licensing regime requires that all people who carry out safety related activities, including design work, are suitably qualified and experienced for that job.

NS-R-1 3.1: The design organization shall: (6) ensure that a safety culture is maintained.

18.8 The UK's approach to Safety culture is addressed under Article 12.

18(i) Defence in Depth

18.9 In the UK, defence in depth is seen as a fundamental element of reactor safety and has been a requirement for all nuclear installations since the beginning of the reactor programme. The UK's system includes defence in depth in:

- the design of multiple barriers to prevent radiological release from design base accidents and severe accidents;
- good operational safety; and
- mitigation of radiological consequences.

NS-R-1 4.1: In the design process, defence in depth shall be incorporated. The design therefore: (1) shall provide multiple physical barriers to the uncontrolled release of radioactive materials to the environment.

18.10 The physical barriers preventing uncontrolled release of radioactive materials are dependent on the specific reactor. However they all include:

- Fuel matrix;
- Fuel cladding;
- Pressure circuit;
- Containment;
- Control and protection system; and the
- Use of single failure criteria.

NS-R-1 4.1: The design: (2) shall be conservative, and the construction shall be of high quality, so as to provide confidence that plant failures and deviations from normal operations are minimized and accidents prevented.

18.11 The licensees' design safety guidelines will define the requirements for plant components to meet the overall safety case requirements. All structures, systems and components are allocated a safety categorisation that take account of the consequences of their potential failure and of the failure frequency requirements placed on them in the safety analysis. This categorisation is used to determine the standards to which those items are constructed.

18.12 A qualification procedure confirms that all safety systems and safety related equipment will perform their required safety functions throughout their operational lives under the operational, environmental and accident conditions specified in the design. The procedure, where reasonably practicable, includes a demonstration that individual items can perform their required functions under the specified conditions.

NS-R-1 4.1: The design: (3) shall provide for control of the plant behaviour during and following a postulated initiating event (PIE), using inherent and engineered features.

18.13 Structures, systems and components important to safety are designed to be inherently safe or to fail in a safe manner. Potential failure modes are identified, using a formal analysis where appropriate. External and internal hazards that could affect the safety of the plant are identified. They are treated as potential initiating events of fault sequences and, where appropriate, are taken in combination with other plant faults.

18.14 The design ensures that safety systems are available to reduce the frequency or limit the consequences of fault sequences. There are design requirements to ensure that no fault or hazard, disables the safety systems provided to safeguard against that event. The principles of diversity and redundancy are applied to ensure that all safety systems cannot be disabled by
common mode failures.

NS-R-1 4.1: The design: (4) shall provide for supplementing control of the plant.

18.15 The licensees' design safety guidelines and the HSE Safety Assessment Principles (SAPs) require that all UK nuclear installations are provided with the facility to shutdown the reactor operations should the control room become unavailable to operators.

NS-R-1 4.1: The design: (5) shall provide for equipment and procedures to control the course and limit the consequences of accidents as far as practicable.

18.16 The licensees' design safety guidelines and the SAPs require that for the most recent nuclear installations in the UK, a safety system is automatically initiated and no human action should be necessary for a period following the start of the requirement for protective action. The design, however, is such that plant personnel can initiate safety system functions and can perform necessary actions to deal with circumstances that might prejudice safety, but cannot negate correct safety system action at any time.

NS-R-1 4.1: The design: (6) shall provide multiple means for ensuring that each of the fundamental safety functions, i.e. control of the reactivity, heat removal and the confinement of radioactive materials, is performed, thereby ensuring the effectiveness of the barriers and mitigating the consequences of any PIEs.

18.17 The licensees' design safety guidelines and the SAPs require that redundancy is incorporated within the designs of safety systems so as to achieve required high levels of reliability unless it is demonstrated with high confidence that the reliability is achieved by other means.

NS-R-1 4.2: To ensure that the overall safety concept of defence in depth is maintained, the design shall be such as to prevent as far as practicable: (1) challenges to the integrity of physical barriers;

18.18 The licensees' design safety guidelines and the SAPs require that the layout of safety system equipment and safety-related plant and services minimises the effects of internal and external hazards and of any interactions between a failed structure, system or component and other safety-related structures, systems or components.

NS-R-1 4.2: To ensure that the overall safety concept of defence in depth is maintained, the design shall be such as to prevent as far as practicable: (2) failure of a barrier when challenged;

18.19 The licensees' design safety guidelines and the SAPs require that the design meets the single failure criteria. Hence no single random failure assumed to occur anywhere within the safety systems provided to perform a safety function should prevent that function being performed during any normally permissible state of plant availability. Where the single failure criteria is not appropriate (e.g. the reactor pressure vessel) the licensee and NII require a special case procedure for design and construction to give confidence that failure is incredible.

NS-R-1 4.2: To ensure that the overall safety concept of defence in depth is maintained, the design shall be such as to prevent as far as practicable: (3) failure of a barrier as a consequence of failure of another barrier.

18.20 The Design Safety Guidelines and SAPs require that safety barriers should be designed to ensure diversity, redundancy and segregation in the structures, systems and components that are important to safety.

NS-R-1 4.3: The design shall be such that the first, or at most the second, level of defence is capable of preventing escalation to accident conditions for all but the most improbable PIEs.

18.21 This is a requirement of the Design safety Guidelines and SAPs. The design has to demonstrate that these levels of protection include not only engineered control and safety systems but also aspects such as conservative design, quality assurance, accident management strategies and off-site emergency response.

18.22 Diversity and segregation are used, as appropriate, where the possibility of common cause failures would otherwise threaten the achievement of the reliability required for a safety function. Where high reliability is sought from a safety system through the use of redundant identical components, measurements or actions, a common cause failure limitation is placed on the claimed reliability of the system.

18.23 Provisions are made for monitoring and inspecting safety systems, safety-related structures, and components in service or at intervals throughout plant life commensurate with the reliability required of each item. In especially difficult circumstances where this cannot be done, either additional design measures are incorporated to compensate for the deficiency, or adequate long-term performance is achieved without such measures.

18.24 The HSE, during its assessment of the licensee's safety case, checks that the above approach has been followed, so far as is reasonably practicable.

NS-R-1 4.5: The objective of the safety approach shall be: to provide adequate means to maintain the plant in a normal operational state; to ensure the proper short term response immediately following a PIE ….

18.25 The design basis analysis establishes the minimum safety system requirements for each initiating fault and also identifies the operator's administrative requirements. It therefore provides information for:

- the trip setting and performance requirements for the safety systems and safety related equipment;
- the determination of the plant operational limits and the formulation of the operating rules; and
- the preparation of the plant operating instructions

NS-R-1 4.11: Design provisions shall be made to ensure that potential radiation doses to the public and the site personnel do not exceed acceptable limits and are as low as reasonably achievable.

18.26 The licensees' design safety guidelines and the SAPs define the limits that must be met to safeguard workers and public during normal operation and fault conditions. For normal operation the design has to demonstrate that the use of remote operations equipment or shielding has been used to meet the ALARP principle. For each design base fault sequence or bounding case, which leads to a release of radioactive material, the radiological analysis to determine the maximum effective dose to a person outside the site assumes:

i) that the person remained at the point of greatest dose for the duration of the release (except for extended releases, when more realistic times at the location can be assumed);
ii) weather conditions occurred that produce the highest dose to the person; and
iii) there were no off-site emergency counter measures.

18.27 The result of these analyses form part of the pre-construction safety report (PCSR). HSE will not allow construction to commence until it is satisfied that the PCSR demonstrates that the design has met the licensees' Design Safety Guidelines and the SAPs.

S-R-1 4.12: Plant states that could potentially result in high radiation doses or radioactive releases shall be restricted to a very low likelihood of occurrence …

18.28 The fault analysis process leads to the determination of the Design Basis Accidents (DBAs) for the nuclear installation. These accidents are drawn from the fault analysis but do not include initiating faults that are determined to be very improbable and meet the following criteria:

(i) internal plant faults which have an expected frequency lower than about 10^{-5} per year;
(ii) failures of structures, systems or components which form a principal means of ensuring nuclear safety and which have been accepted by a comprehensive examination, using relevant scientific and technical issues, to ensure an acceptable standard of integrity commensurate with the potential radioactive consequences if they fail; and
(iii) external hazards to the plants where it can be demonstrated that their frequency is less than once in 10 thousand years.

S-R-1 4.12: The potential radiological consequences of plant states with a significant likelihood of occurrence shall be only minor.

18.29 The design basis fault sequences are identified starting with each design basis initiation fault, i.e. those not excluded by the criteria outlined above. They included as appropriate: failures consequential upon the initiating fault; failures expected to occur due to having a common cause; and single failures within the safety systems. The analyses of DBAs are done on a conservative basis and assume the worst normally permitted configuration of equipment and the unavailability of equipment for maintenance, test or repair.

18.30 The design basis fault sequences are expected to show that:

i) none of the physical barriers to the escape of radioactivity can be breached or if any are, then at least one barrier remains intact;
ii) there is no release of radioactivity off-site that can be in excess of that allowed in the SAPs; and
iii) no person on the site will receive a dose in excess of the statutory limits.

NS-R-1 5.1: All structures, systems and components, including software for instrumentation and control, that are items important to safety shall be first identified and then classified on the basis of their function and significance with regard to safety. They shall be designed, constructed and maintained such that their quality and reliability is commensurate with this classification.

18.31 The licensees' design safety guidelines and HSE Safety Assessment Principles (SAPs) (P69, P82-85) address the categorisation of structures systems and components according to their safety significance. For the highest safety category the SAPs also identify the need for conservative design and rigorous application of all other relevant SAPs in line with the ALARP requirements.

18.32 The SAPs also identify where appropriate international codes and standards should be used and when normal industrial standards can be applied.

18.33 The PCSR is expected to demonstrate that safety related structures, systems and components have been correctly identified and categorised and appropriate standards applied.

NS-R-1 5.3: Appropriately designed interfaces shall be provided between structures, systems and components of different classes to ensure that any failure in a system classified in a lower class will not propagate to a system classified in a higher class.

18.34 To deliver the overall design intent and to meet the requirements of the Design Safety guidelines and the SAPs, the interaction between structures systems and components of different categories are fully addressed in the PCSR.

18(ii) Use of Established/Proven Engineering Practice

NS-R-1 3.6: Wherever possible, structures, systems and components important to safety shall be designed according to the latest or currently applicable approved standards; shall be of a design proven in previous equivalent applications …

18.35 At any point in time, the licensees' Design Safety Guidelines and the SAPs ensure that nuclear installations are designed to modern standards. For example, Sizewell B and the more recent AGRs included the qualification of equipment for all DBAs within their safety cases. This qualification often involved arduous testing or comprehensive analysis or both, usually in line with modern national or international standards or other specific regulatory requirements.

18.36 SAPs P 86 – P89 address the processes that were followed to ensure that appropriate design data and models were used. These principles also address the validation of models and

the need for conservative design in cases of uncertainty on the accuracy of data. The SAPs note that the provisions should be made to review new data, scientific knowledge and operating experience.

NS-R-1 3.7: Where an unproven design or feature is introduced or there is a departure from an established engineering practice, safety shall be demonstrated to be adequate …

18.37 Before any new design or feature is introduced, the licensee must submit a safety case to show that appropriate safety standards have been met. This can include type testing, experiments or other means to clearly indicate that the proposal is safe. HSE will only allow construction to commence when it is satisfied that the safety case demonstrates compliance with the SAPs.

18.38 HSE SAP P75 addresses the issue of equipment qualification. This states that a qualification procedure should confirm that the equipment will perform its required function under the operational, environmental and accident conditions throughout its operational life.

NS-R-1 3.7: The development … shall be monitored in service, to verify that the expected behaviour is achieved.

18.39 The SAPs state that arrangements should be in place for the recording and retrieval of lifetime data. This is supported by LC 28 that requires the licensee to make adequate arrangements for the examination, inspection, maintenance and testing of all plant that may effect safety.

18.40 Spurious operation and unsafe failure modes are addressed in the fault analysis that is part of the safety case. Anticipated failure or expected lifetimes of component are taken into account as part of routine maintenance programmes.

NS-R-1 3.9: The design shall take due account of relevant operational experience that has been gained in operating plants and of the results of relevant research programmes.

18.41 Where there is relevant operating experience to support design assumptions, this is included in the licensees' safety case as part of the evidence to show the safety of the plant. The responses to Article 19 address operational feedback and nuclear safety research. Application of the SAPs ensures that this is incorporated in the design of a new plant.

18 (iii) Operability, Man/machine interface

NS-R-1 3.3: The design management shall ensure that the requirements of the operating organization are met and that due account is taken of the human capabilities and limitations of personnel.

18.42 The Design Safety Guidelines will specify the operating requirements that the designer must meet. Particular emphasis is placed on identifying the safety actions required of the operators and specifying the user interface design during the design stage of the UK's

nuclear installations. Article 12 provides a statement of the UK approach to ensuring an adequate treatment of human factors throughout the life cycle of the plant.

NS-R-1 3.3: The design organization shall supply adequate safety design information to ensure safe operation and maintenance of the plant and to allow subsequent plant modifications to be made, and recommended practices for incorporation into the plant administrative and operational procedures (i.e. operational limits and conditions).

18.43 At the time the current fleet of nuclear installations were built in the UK, the licensee was fully involved in the design of its reactors and able to retain comprehensive details of the design, which have been used and updated when subsequent plant modifications have been made.

ARTICLE 19. OPERATION

"**Each Contracting Party shall take the appropriate steps to ensure that:**

(i) the initial authorization to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;

(iii) operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;

(iv) procedures are established for responding to anticipated operational occurrences and to accidents;

(v) necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;

(vi) incidents significant to safety are reported in a timely manner by the holder of the relevant licence to the regulatory body;

(vii) programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies;

(viii) the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal."

19.1 The following report on Article 19 has been based around the IAEA requirement documents NS-R-2 and SS115.

19.2 In the UK, the operational phase of a nuclear installation is regulated principally through the Licence Conditions (LCs) (see Annex 5) attached to the nuclear site licence (see Article 7). Compliance with these Conditions is monitored by the HSE through inspection and assessment (see Article 14). The LCs cover all aspects of operation that have a relevance to safety and it is an offence for a licensee to contravene the requirements of a nuclear site licence. Annex 2 and Article 8 describe the powers under the licence with which HSE can control the operation of UK nuclear plant. Regular nuclear site inspections by NII inspectors are the main method of ensuring that the nuclear licensees are complying with the LCs and operating their plant safely. The relevant LCs for each requirement of Article 19 are discussed below:

19(i) Safety Analysis and Commissioning Programme

19.3 The report on Article 14 addresses the safety analysis undertaken prior to initial authorisation to operate a nuclear installation.

NS.R.2, 4.1-4.8:
4.1. The commissioning programme shall provide evidence that the installation as constructed meets the design intent and complies with the safety requirements. Operating procedures shall be validated to the extent practicable as part of the commissioning programme, with the participation of the future operating personnel.
4.2. The commissioning programme shall meet the objectives of the operating organization, including safety objectives, and shall be subject to approval by the regulatory body.
4.3. Authorities and responsibilities for the commissioning process shall be clearly defined and delegated to the individuals performing the work. The interfaces between those groups involved in commissioning (such as groups for design, for construction, of contractors, for commissioning and for operations) shall be clearly defined and properly controlled.
4.4. A sufficient number of qualified operating personnel, at all levels and in all areas, shall be directly involved in the commissioning process.
4.5. To confirm the applicability and quality of the operating procedures, they shall be verified to ensure their technical accuracy and validated to ensure their usability with the installed equipment and control systems, as far as possible prior to loading fuel into the core. This process shall continue during the commissioning phase. This verification and validation process shall also apply to procedures for maintenance, surveillance and plant chemistry as appropriate.
4.6. The operating organization shall ensure that the commissioning programme includes all the tests necessary to demonstrate that the plant as installed meets the requirements of the safety analysis report and satisfies the design intent, and consequently can be operated in accordance with the operational limits and conditions. The commissioning programme shall also provide the regulatory body with a means of identifying hold points in the commissioning process. No tests shall be performed which could put the plant into conditions that have not been analysed. The programme shall ensure that 'baseline' data on systems and components, which are important for ensuring the safety of the plant and for subsequent safety reviews, are collected and retained.
4.7. From the start of commissioning, adequate work control and modification procedures shall be put in place to ensure that the objectives of commissioning tests are not invalidated in the process of performance of the commissioning programme.
4.8. From construction to commissioning, and finally to operation, the plant shall be adequately monitored and maintained in order to protect plant equipment, to support the testing phase and to continue to maintain consistency with the safety analysis report. Records of operations and maintenance shall be kept starting from the initial energization and operation of each plant system, and they shall be retained by the operating organization in proper archives for periods as agreed with the regulatory body.

19.4 LC 21 requires the licensee to make and implement adequate arrangements for the commissioning of new or modified plant or processes that may affect safety. These arrangements allow the commissioning to be divided into stages and for HSE to specify that the licensee should not proceed from one stage to the next without HSE granting Consent (see Annex 2). Such Consent is dependent upon the licensee providing adequate documentation to justify the safety of plant at that stage. The LC also requires a suitably qualified person or persons to be appointed to control, witness, record and assess the result of the commissioning tests. Full and accurate records are kept for the commissioning programme.

19.5 The Pre-commissiong Safety Report builds on the Pre construction Safety Report to reflect the plant as built (i.e to reflect design modifications). The commissioning programme required under LC21 is produced by the licensee to ensure that all systems important to safety are tested to demonstrate that the plant complies with the design intent and is ready for operation. LC 23 requires operating limits to be derived from the safety cases and these in turn provide the basis for operating rules and operating procedures. These procedures are tested as part of the commissioning programme. Any changes to the plant or procedures found to be necessary during the commissioning process are implemented under the arrangements established under Licence condition 21.

NS.R.2, 4.10 - 4.11:
4.10. Initial fuel loading shall not be authorized until all pre-operational tests deemed necessary by the operating organization and the regulatory body have been performed and results acceptable to both parties have been obtained.
4.11.Reactor criticality and initial power raising shall not be authorized until all tests deemed necessary by the operating organization and the regulatory body have been performed and results acceptable to both parties have been obtained.

19.6 There are regulatory controls in place to ensure these major activities do not take place without the Consent of HSE. The Commissioning Programme identifies key stages when HSE Consent is required before further progress towards operation can be made. These are such times as: the bringing of nuclear fuel onto site; loading fuel into the reactor; bringing the reactor to criticality; and various power levels up to full power. The final Consent of the Commissioning phase is the Consent to move to routine operation. This is not issued until the commissioning tests and the test results substantiated the safety case, and all the necessary documents and systems are in place for the continued operation and maintenance of the plant.

NS.R.2, 4.12: All the functions of the operating organization shall be performed at the appropriate stages during commissioning. These functions shall include responsibilities for: management; training of personnel; the radiation protection programme; waste management; management of records; fire safety; physical protection; and the emergency plan.

19.7 Prior to commissioning, key management functions are established and are tested during the commissioning process. This is ensured by the licensees' arrangements to comply the licence conditions. These, as a whole, set out a framework for good safety management. Specific conditions addressed particular issues: LC10 (training), LC18 (radiation protection), LCs 32-34 (Waste management), LC6 (records), LC23 (fire safety [as an integral part of the safety case]), LC 11 (emergency plan).

19(ii) Operating Limits and Conditions

NS.R.2, 5.1 and 5.4: Operational limits and conditions shall be developed to ensure that the plant is operated in accordance with the design assumptions and intent. The operational limits and conditions shall have the purposes of:
(1) The prevention of situations which could lead to accidents;
(2) The mitigation of the consequences of any such accidents, if they do occur.

19.8 Licence condition 23 requires the licensee to produce an adequate safety case to demonstrate the safety of a plant and to identify the conditions and limits that are necessary in the interests of safety. The safety case limits are the measurable plant parameters that define the envelope for safe operation, and the conditions (plant configurations, availability and operator actions) necessary to keep plant within this envelope. These limits and conditions
are the Basis of the Operating Rules (ORs).

19.9 LC 24 requires the licensee to ensure that the safety case limits and conditions of the ORs are an integral part of the written instructions to operators. The licensee will ensure that the limits and conditions in the Operating Instructions have a safety margin. The safety margin is established having regard to the plant transients arising in normal operation, or in the event of a plant system breakdown, so that there is high confidence that no transgression of the ORs' limits will occur and safety will not be jeopardised. Regarding the mitigation of the consequences of an accident the Operating instructions for normal operation are supplemented by Emergency Operating Procedures (see Article 16). ORs have been replaced at some nuclear installations with HSE's agreement by Technical Specifications, which serve the same function.

NS.R.2, 5.2: Operating personnel directly responsible for the conduct of operation shall be thoroughly familiar with the intent and content of the operational limits and conditions in order to comply with the provisions contained therein.

19.10 LC 10 requires the licensee to make and implement adequate arrangements for the training of any person who has any responsibility for operations that may affect safety. Under these arrangements, the training of operations personnel includes familiarisation with the background to operating limits and conditions. An integral part of any proposed changes to the limits and conditions (Operating Rules) includes appropriate operator training on the changes and their effect. Training of operators is fully addressed under Article 11.

NS.R.2, 5.5: The operating organization shall ensure that an appropriate surveillance programme is established and implemented to ensure compliance with the operational limits and conditions, and that its results are evaluated and retained.

19.11 Under LC 25 (operational records) the licensee ensures that adequate records of operation, inspection and maintenance of plant important to safety are made and kept. Under the Quality Assurance arrangements required under LC 17, the operators safety staff periodically audit these records to ensure compliance with procedures. Periodic review of procedure and processes is required under LC 15.

19(iii) Operating, Maintenance, inspection and testing procedures

Operations

NS.R.2, 5.10 – 11: A comprehensive administrative procedure shall be established which contains the rules for the development, elaboration, validation, acceptance, modification and withdrawal of operating instructions and procedures. Operating [instructions and] procedures shall be developed which apply comprehensively for normal, abnormal and emergency conditions.

19.12 Paragraph 19.9 describes identification of operating limits and conditions and the subsequent derivation of Operating Rules and Instructions. The administrative procedures for this are controlled by the licensees' arrangements. The arrangements under LC 14 include internal peer review, discussion and endorsement by the Licensees' Nuclear Safety Committee (LC 13) and, where appropriate, submission to HSE for agreement or Approval. Subsequent changes to operating rules and operating instructions are processed via the arrangements made under LC 22 (Modification or Experiment on existing Plant).

19.13 When the need to change a limit or condition is identified, the licensee submits to HSE a safety case that substantiates the proposed limits and conditions. Normally, HSE would only approve the limits and conditions defining the nuclear safety envelope in the form of the operating rules. Once approved, no alteration or amendment can be made to such operating rules unless the HSE has approved the alteration or amendment.

19.14 In the particular case where the results of operation, maintenance or inspection show that the safe condition or safe operation of the plant may be affected, the licensee's arrangements ensure that HSE receives a safety case that substantiates the continued operation of a reactor, whether or not the Operating Rule limits and conditions need to be changed.

NS.R.2, 5.14: It shall be ensured that operating personnel are knowledgeable of, and have control over, the status of plant systems and equipment for all operational states. Only designated and suitably qualified members of the operating personnel shall control or supervise any changes in the operational states of the plant. No other person shall interfere in their decisions relevant to safety.

19.15 LC 12 requires that all people who carry out safety related activities to be suitably qualified and experienced. LC 24 ensures that all operations that may affect safety, including any instructions to implement ORs, are undertaken in accordance with written operating instructions. In addition to these requirements, LC 26 (control and supervision of operations) requires that no operations are carried out which may affect safety, except under the control and supervision of suitably qualified and experienced persons appointed by the Licensee for that purpose.

NS.R.2, 5.18: If there is a need to conduct a non-routine operation, test or experiment, it shall be the subject of a safety review. The specific operational limits and conditions shall be determined and a special procedure shall be prepared. If, during the non-routine operation, any of the specific operational limits or conditions is violated, corrective action shall be taken immediately and the event shall be reviewed.

19.16 The arrangements made under LC 22 (Modification or Experiment on existing Plant) prescribe the procedures for carrying out a non-routine operation or a test. Such activities are managed in the same way as any other change (such as a plant modification) that may affect the safety case. The arrangements will require a full justification for the non-routine operation or test, and clearly demonstrate that all safety implications have been addressed, including the development of appropriate operating procedures. Before implementation, the safety case will be internally peer reviewed and endorsed by the licensee's Nuclear Safety Committee. The licensees will also need the agreement of HSE.

Maintenance, Inspection and Testing

NS.R.2, 6.1: The operating organization shall prepare and implement a programme of maintenance, testing, surveillance and inspection of those structures, systems and components which are important to safety. This programme shall be in place prior to fuel loading and shall be made available to the regulatory body. It shall take into account operational limits and conditions as well as any other applicable regulatory requirements and it shall be re-evaluated in the light of experience.

19.17 LC 28 requires licensees to make and implement arrangements for the regular and systematic examination, inspection, maintenance and testing of all plant which may affect safety. This work is set out in a Maintenance Schedule that details the scope and timing of maintenance. This Schedule identifies those examinations, inspections, maintenance and tests that are required to demonstrate the continued ability of the plant to meet claims in the safety case. The intervals between Maintenance Schedule activities are determined by the safety case, operational experience and engineering judgement. The work is carried out in accordance with schemes laid down in writing by suitably qualified and experienced persons under the control and supervision of an appropriate person specifically appointed for that task who must sign a full and accurate report on completion of the work. Any examination, inspection, maintenance or test that shows that the safety of the plant may be affected is reported to the licensee, who takes appropriate action.

19.18 In addition to LC 28, HSE also has powers under LC 29 (duty to carry out tests and inspections). HSE , after consultation with the licensee, may require the licensee to perform any tests, inspections or examinations that it may specify. All UK nuclear reactors must shut down at regular intervals for inspection and testing. These statutory shutdowns occur every 2 or 3 years depending on the reactor type. Once shutdown, the reactor cannot be restarted without the Consent of HSE.

Plant Modifications

NS.R.2, 7.2 –7.6, 7.9:
7.2. Proposed modifications to structures, systems and components important to safety, which affect the bases on which the operating licence was issued, to the operational limits and conditions, and to procedures and other documents originally approved by the regulatory body shall be submitted to the regulatory body for prior approval. Any other proposed modifications shall be submitted to the regulatory body for prior approval if so required.
7.3. … the capability of performing all safety functions shall not be degraded. Safety and enhancement of safety shall be considered in connection with all actions causing plant modifications. Such modifications shall not reduce the level of safety.
7.4. The operating organization shall establish a procedure to ensure proper design, review, control and implementation of all permanent and temporary modifications. This procedure shall ensure that the requirements of the plant safety analysis report and applicable codes and standards are met.
7.5. Implementation and testing of plant modifications shall be performed in accordance with the plant's work control system and appropriate testing procedures.
7.6. Temporary modifications (including defeat of interlocks, installation of jumpers and lifted leads) shall be clearly identified at the point of application and any relevant control position. Operating personnel shall be clearly informed of these temporary modifications and of their consequences for the operation of the plant, under all operating conditions.
7.9. Modifications relating to organizational aspects which are relevant to the safe operation of the plant shall be submitted to the regulatory body.

19.19 UK has an ageing reactor population and inevitably some items become obsolete. At present there is adequate support for the plants that were built to older standards. Where obsolete equipment cannot be replaced directly as part of routine maintenance (for example some of the instrumentation and control equipment), alternative equipment must be evaluated using established procedures for plant modifications and HSE approval obtained. The process for modifications is prescribed in the arrangements made under LC22. Significant safety changes need to be agreed by HSE before implementation while others need to be reported to HSE.

19.20 The process for the implementation of modifications follows the procedure that is set out under article 14 paragraphs 14.18 – 14.20.

19(iv) Operational Occurrences

NS.R.2, 5.8: After an abnormal event, the plant shall be brought into a safe operational state, which could necessitate shutting down the reactor. In the event that the operation of the plant deviates from one or more of the established operational limits and conditions, the appropriate remedial actions shall be taken immediately, and the operating organization shall undertake review and evaluation of the case and shall notify the regulatory body in accordance with the established event reporting system.

19.21 The plant protection system will ensure that, after an operational occurrence, the plant is brought back into a safe state. The safety case identifies a range of fault conditions that will generate plant alarms for operator action or automatic response. The Operating Instructions and Emergency operating procedures required by LC 24 identify the necessary operator actions. Beyond the design basis, reasonably foreseeable but remote fault conditions are addressed by providing strategies and guidelines to help operators decide on their emergency response. Even more remotely, approaches to the management of serious accidents have been considered to identify equipment and materials. The arrangements for dealing with Accidents and Emergencies are set out under Article 16. The licensee has key responsibilities under these arrangements and, in particular, bringing the plant back to a safe condition. To this end the licensee, under LC 11 (on emergency arrangements), ensures that all persons who might
be involved are properly instructed and rehearsed in the procedures.

19.22 In the event of an incident on site, arrangements made under LC7 require that the licensee, notifies HSE, records, investigates and reports such incidents. If appropriate, HSE will enforce corrective actions.

19(v) Engineering and Technical Support

19.23 Licence condition 36 ensures that the licensees have access to sufficient technical expertise for all stages of a plants life. The licensees' in-house technical resource has significantly reduced over a number of years and the tendency has been for expertise has been bought in as and when required from contractors. The HSE view is that this is acceptable providing that the licensees retain sufficient expertise to be an "intelligent customer".

19.24 The maintenance of technical expertise in the nuclear industry was an issue that was discussed in detail at the CNS second review meeting. Contracting Parties were asked to provide information in their third reports. The following paragraphs present the UK position.

19.25 At a time when there has been little investment in new plant for a number of years, there are fewer scientists and engineers choosing careers in the nuclear industry. Although at present there are no major difficulties in the UK, it is evident that unless the situation is reversed, there could be significant future problems, particularly if there is a decision to build new nuclear installations. There are several initiatives in UK to try and remedy this situation.

19.26 HSE continues to oversee the safety competence of the licensees, and monitors their

level of safety expertise required now and with regard to future business needs.

19.27 At the national level, the Government has implemented the recommendations of the Nuclear Skills Group, which was set up in response to an OECD report and given responsibility for implementing changes to the Sector Skills Council, Cogent. Cogent is advised by a Nuclear Employers Group and Advisory Council on matters to do with supply and demand of nuclear skills. At the university level, Manchester University is setting up a Nuclear Centre which will offer a range of courses and research on nuclear (fission and fusion) topics.

19.28 The Government's Energy Bill recognised the need to keep the nuclear option open and through the Government Chief Scientist's High Level Energy Group and a new research programme, steps are being taken to maintain nuclear skills, which might be needed by the UK nuclear industry in the future.

19.29 Research and development in Nuclear safety is supported in UK. This provides a source of knowledge and expertise as well as helping to maintain nuclear competencies

Research and Development

19.30 There are issue associated with operating reactors that require technical substantiation. This substantiation is obtained by research and development programmes. The licensees commission and undertake research to support the safe operation of their nuclear installations. In addition, the UK Government has given HSE the responsibility to co-ordinate a long-term generic (i.e. not site specific) safety research programme with the primary objectives of ensuring that:

i) adequate and balanced programmes of nuclear safety research continue to be carried out, based on issues likely to emerge both in the short and long term;
ii) as far as reasonably practicable, the potential contribution research can make to securing higher standards of nuclear safety is maximised; and
iii) the results of the research having implications for nuclear safety are disseminated as appropriate.

19.31 There are two secondary objectives of this research programme that recognise the need to maintain technical competence at a time when fewer people are choosing nuclear engineering as a career in the UK. These are:

i) to take account of the desirability of maintaining a sufficient range of independent technical capability to ensure the attainment of the primary objective; and
ii) to ensure that proper account is taken of the advantages of international collaboration in furthering the primary objectives.

19.32 HSE directs the Programme, on behalf of HSC, by identifying safety issues that are expressed in the Nuclear Research Index [48]. The Programme embraces the full range of safety issues on a nuclear reactor plant. Information on each of these projects is available from HSE's Nuclear Research Register [49], which is produced annually.

NS.R.2, 2.8: The operating organization shall be staffed with competent managers and sufficient qualified personnel having a proper awareness of the technical and administrative requirements for safety and motivated to be safety conscious.
NS.R.2, 2.10: All activities that may affect safety shall be performed by suitably qualified and experienced persons. Certain activities with a bearing on safety may be performed by qualified persons outside the plant structure (such as contractors). These activities shall be clearly defined in writing. The implementation of these activities on or off the site shall be subject to the approval of the plant management. Contractors' staff shall be properly controlled and supervised by the plant staff.

19.33 Under the LCs there are a number of requirements aimed at ensuring that there is sufficient engineering and technical support available in all safety-related fields throughout the life of a nuclear installation. In particular, LC 12 (duly authorised and other suitably qualified and experienced persons) has a general requirement that only suitably qualified and experienced persons should perform any duties that may affect the safety of operations on the site. Within this overall provision, there is the specific requirement under LC 26 (control and supervision of operations) for the appointment in appropriate cases for persons to control and supervise operations that may affect plant safety.

19.34 Licensees arrangements under LC 17 (Quality Assurance) ensure appropriate control and supervision of contractor's staff.

19(vi) Reporting of Incidents

19.35 LC 7 (incidents on the site) is a general requirement to make arrangements to notify, record, investigate and report incidents:

(i) as is required by any other condition attached to the licence;
(ii) as the HSE may specify; and
(iii) as the licensee considers necessary.

19.36 Under (i) above there are, for example, requirements to notify, record, investigate and report incidents arising under LC 23 (Operating Rules), LC 28 (Examination, Inspection, Maintenance and Testing), and LC 34 (Leakage and escape of radioactive material and radioactive waste). Incidents to be notified, etc., include those referred to in NI Act section 7 [7]; in the Nuclear Installations (Dangerous Occurrences) Regulations 1965[49]; the IRR99 [8], regulations 25 and 30. In making the arrangements required under LC 7, the licensees include the need to notify incidents within the scope of:

(i) Occurrences on a nuclear installation site, under section 22(1) of the NIA65, are to be reported by the quickest means possible under section 4(1) of the Nuclear Installations (Dangerous Occurrences) Regulations 1965 to the DTI and HSE;
(ii) A confirmed breach of, or discharge expected to breach quantitative limits of a Certificate of Authorisation for the disposal of radioactive waste issued under the RSA93 [12];
(iii) A confirmed release to atmosphere or spillage of a radioactive substance which exceeds or is expected to exceed, the limits set out in Column 4 of Schedule 8 of the

IRR99, (except where the release is in a manner specified in an Authorisation under RSA93) to be notified forthwith to HSE; and

(iv) A confirmed or suspected over exposure of a worker to ionising radiation under Section 25 of the IRR99 to be notified as soon as practicable to HSE;

NS.R.2, 9.5: Periodic summary reports on matters relating to safety shall be provided by the operating organization to the regulatory body if so required. Reports and records relevant to reviews carried out following abnormal events and accidents, and reports on modifications, shall be kept as required and shall be available to the regulatory body.

19.37 HSE has made arrangements with licensees to be informed of incidents covered by international reporting arrangements, for which HSE is the UK reporting authority, i.e.

(i) the International Nuclear Event Scale (INES); and
(ii) the IAEA/NEA Incident Reporting System (IRS).

19.38 Certain incidents are covered by agreements for ministerial reporting to Parliament, these are issued by HSE in a Quarterly Statement. The criteria for ministerial reporting are:

(i) dangerous occurrences reportable under Nuclear Installations (Dangerous Occurrences) Regulations 1965;

(ii) confirmed exposure to radiation of individuals which exceed or which are expected to exceed the dose limits specified in Schedule 4 to the IRR99; and

(iii) examination, inspection, maintenance or test of any part of the plant that has revealed that the safe operation or condition of the plant may be significantly affected.

19.39 The UK is a signatory to the 1986 IAEA Convention on 'Early Notification of a Nuclear Accident' which requires notifying the IAEA when "... a release of radioactive materials occurs or is likely to occur and which has resulted or may result in an international transboundary release that could be of radiological safety significance for another state". The UK competent authority and contact points for issuing and receiving notification and information on the nuclear accident are DTI and Defra, respectively.

19.40 In addition to reporting nuclear incidents, HSE publishes a quarterly newsletter that reports key events at nuclear installations in the UK as well as the current activities of the Regulatory Authority.

19 (vii) Analysis of Operating Experience

NS.R.2, 2.21- 2.26:
2.21. Operating experience at the plant shall be evaluated in a systematic way. Abnormal events with significant safety implications shall be investigated to establish their direct and root causes. The investigation shall, where appropriate, result in clear recommendations to the plant management, which shall take appropriate corrective action without undue delay. Information resulting from such evaluations and investigations shall be fed back to the plant personnel.
2.22. Similarly, the operating organization shall obtain and evaluate information on operating experience at other plants to derive lessons for its own operations.
2.23. Operating experience shall be carefully examined by designated competent persons for any precursors of conditions adverse to safety, so that any necessary corrective action can be taken before serious conditions arise.
2.24. All plant personnel shall be required to report all events and shall be encouraged to report on any 'near misses'1 relevant to the safety of the plant.
2.25. Plant management shall maintain liaison as appropriate with the organizations (manufacturer, research organization, designer) involved in the design, with the aims of feeding back information on operating experience and obtaining advice, if necessary, in the event of equipment failures or abnormal events.
2.26. Data on operating experience shall be collected and retained for use as input for the management of plant ageing, for the evaluation of residual plant life, and for probabilistic safety assessment and periodic safety review.

19.41 Operational matters which may affect safety and which are identified during operation or during maintenance, inspection and testing are notified, recorded, investigated and reported as required by LC 7. These requirements ensure that experience gained during operation is properly considered and any findings or recommendations that will improve safety are recognised and acted upon. The operational records required under LC 25 not only demonstrate to the regulators compliance with site licence and other regulatory requirements, but also constitute part of the plant history that operators need to make safety and commercial judgements. For instance, the results of routine examinations of the plant under LC 28 may be used to justify a change to the interval between maintenance or a change from preventive maintenance to condition-based maintenance.

19.42 The licensee arrangements for investigation of plant events include requirements for impact on other installations and operators to be considered in off-site reporting and regular reviews of such reports by all nuclear installation licensees. The outcome of this review could be a dissemination of a plant event on one installation with a requirement on each other installation to assess and report formally on its impact on their plant.

19.43 An analysis of operating experience is a key part of the periodic safety reviews that are required under LC 15. The main review is carried out every 10 years but other reviews also take place before start-up after statutory outages.

19.44 HSE is responsible for national publication of the results of its regulatory activities (such as the assessment of licensees' Periodic Safety Reviews) and international reporting of events. HSE brings to the attention of licensees any international events of significance. Licensees distribute information through WANO and other organisations, which also provide international experience that may be relevant to UK operators.

19(viii) Radioactive Waste

NS-R-1 6.90: Adequate systems shall be provided to treat radioactive liquid and gaseous effluents in order to keep the quantities and concentrations of radioactive discharges within prescribed limits. The ALARA principle shall be applied.

19.45 LC 34 on leakage and escape requires radioactive material or waste to be controlled and contained so that it does not leak or escape. Licensees have to demonstrate to the satisfaction of the regulator that this is the case. Any leak or escape must be notified, recorded, investigated and reported, as required by the arrangements made under LC 7. Each site has a discharge authorisation issue by the Environment Agency. The licensee must demonstrate how it complies with such authorisations.

NS.R.2, 8.8 – 8.9:
8.8. The generation of radioactive waste shall be kept to the minimum practicable in terms of both activity and volume, by appropriate operating practices. Treatment and interim storage of radioactive waste shall be strictly controlled in a manner consistent with the requirements for safe final disposal.
8.9. The operating organization shall establish and implement a programme to manage radioactive waste safely.

19.46 The UK currently has no plans for the disposal of intermediate level waste (ILW). The independent Committee on Radioactive Waste Management is considering various management options for radioactive wastes with widespread public consultation. This committee is due to report in 2006.

19.47 In the meantime, LC 4 on restriction of nuclear matter on the site requires that there must be adequate arrangements for the storage of nuclear matter (which includes radioactive waste generated on the site). These arrangements include the preparation and assessment of a safety case and the identification of limits and conditions necessary in the interests of safety. In addition, HSE, EA and SEPA are working on improved regulatory arrangements to ensure that ILW is managed in a sustainable way taking account long-term environmental considerations. This will provide operators with greater certainty with respect to the eventual disposal of conditioned waste taking into account safe interim storage.

19.48 LC 32 on accumulation requires that, as far as is reasonably practicable, the rate of production and the total quantity of radioactive waste on the site at any one time is minimised. The quantity, type and form of the radioactive waste accumulated or stored may be subject to limitations specified by HSE. HSE assessment of PSRs currently includes consideration of radioactive waste management and associated safety cases.

NS.R.2, 8.10: Any authorized discharge limits shall be included in the operational limits and conditions.

19.49 LC 33 on disposal requires the disposal of radioactive waste to be in accordance with an Authorisation granted under RSA93. Hence, discharges of liquid and gaseous radioactive waste, and disposals of solid waste, are regulated by conditions and limitations attached to an authorisation granted by the appropriate regulatory body under RSA 93. However, nuclear licensed sites are exempt from the requirement to have a RSA 93 authorisation to accumulate

radioactive waste on the sites. The regulation of such accumulation of radioactive waste is undertaken using licence conditions (see paragraph 19.41 above) at least as stringently as it would if it came under RSA 93.

19.50 In the UK, regulation under RSA 93 is a devolved matter. Therefore, there are three regulatory authorities in the UK who have responsibility for issuing radioactive discharge authorisations under RSA 93. These authorities are: The Environment Agency (EA), for discharges made in England and Wales; The Scottish Environment Protection Agency (SEPA), for discharges made in Scotland; and The Environment and Heritage Service of the Department of the Environment, for discharges made in Northern Ireland. In addition, the Food Standards Agency has responsibility for all aspects of food safety and is consulted on the setting of authorisations to assess the impact and uptake of radioactive discharges to the food chain.

19.51 Authorisations for nuclear licensed sites granted by the environment agencies set limits on the discharge of specific radionuclides, or groups of radionuclides. The EA incorporates conditions for annual, quarterly and monthly limits whereas SEPA places conditions on annual limits when granting authorisations. In addition, the environment agencies include conditions in authorisations that require the site operator to notify, explain reasons why and take action if either daily or monthly discharge levels are higher than normal. The conditions on limit setting require operators to use Best Practicable Means (BPM) to minimise the volume of waste produced and the activity of waste discharged, and to minimise the radiological impacts of discharges. Authorisations require operators to monitor compliance with the authorisation and may also impose requirements on the operators to carry out monitoring of levels of discharged radionuclides in the surrounding environment.

19.52 As a general policy, the limits in discharge authorisations are progressively reduced and are kept close to the level of actual discharges. The UK published a Strategy for Radioactive Discharges to cover the period to 2020. In parallel, Statutory Guidance was issued to the EA, to help it to take account of radiological principles and environmental policy objectives when determining discharge authorisations under RSA 93, in England. Separate guidance has been issued for the other devolved administrations in the UK.

19.53 Information on radioactive discharges, and on the disposal of solid radioactive waste, is provided in the UK's national report for the Joint Convention.

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Glossary and Abbreviations

ACoP	Approved Code of Practice
ACSNI	Advisory Committee on the Safety of Nuclear Installations, the forerunner of NuSAC (see below)
ADS	Approved Dosimetry Service
AGR	Advanced Gas-cooled Reactor
ALARA	As low as reasonably achievable
ALARP	As low as reasonably practicable - the ALARP principle is fundamental to the regulation of health and safety in the UK. It requires that risks should be weighed against the costs of reducing them. Measures must then be taken to reduce or eliminate the risks unless the cost of doing so is obviously unreasonable compared with the risk.
BE	British Energy plc
BEGL	British Energy Generation Ltd.
BEG(UK)L	British Energy Generation (UK) Ltd.
BNFL	British Nuclear Fuels plc
BSL	Basic Safety Limit
BSO	Basic Safety Objective
CDF	Central Database Facility
CIDI	Central Index of Dose Information
CNS	Convention on Nuclear Safety
DBA	Design Base Accident
Defra	Department for Environment, Food and Rural Affairs
DEPZ	Detailed emergency planning zone
DTI	Department of Trade and Industry
EA	Environment Agency for England and Wales
ERL	Emergency Reference Level
GEMA	Gas and Electricity Markets Authority
GTA	Government Technical Adviser
HSC	Health and Safety Commission - created by the HSW Act 1974 and responsible to the Secretary of State for the Environment, Transport and the Regions (and other Secretaries of State) for the administration of the Act. The HSC makes substantial use of independent advisory committees (see NuSAC) who advise the Commission directly.
HSE	Health and Safety Executive - a distinct statutory body with day-to-day responsibility for making arrangements for the enforcement of safety legislation. HSE is the statutory licensing authority for nuclear installations. This function is delegated to senior officials within the HSE's Nuclear Safety Directorate.

HLW	High Level Waste
HSW Act	Health and Safety at Work etc. Act 1974
IAEA	International Atomic Energy Agency
INSAG	International Nuclear Safety Group (of the IAEA)
ICRP	International Commission on Radiological Protection
ILW	Intermediate Level Waste
IMC	Industry Management Committee
INES	International Nuclear Event Scale
INPO	Institute of Nuclear Power Operators
INRA	International Nuclear Regulators Association
IRAC	Ionising Radiations Advisory Committee
IRR99	Ionising Radiations Regulations 1999
IRS	Incident Reporting System
ISI	In-service inspection
ISRS	International Safety Rating System
LCs	Licence Conditions
LLW	Low Level Waste
LTSR	Long Term Safety Review, the forerunner of Periodic Safety Reviews
MCR	Main Control Room
Met. Office	Meteorological Office
mSv	milliSievert
NDA	Nuclear Decommissioning Agency
NEAF	Nuclear Emergency Arrangements Forum
NEBR	Nuclear Emergency Briefing Room
NEPLG	Nuclear Emergency Planning Liaison Group
NETA	New Electricity Trading Arrangements
NGC	National Grid Company
NIA65	Nuclear Installations Act 1965 (as amended)
NII	Nuclear Installations Inspectorate - a part of the HSE's Nuclear Safety Directorate.
NRPB	National Radiological Protection Board
NSD	HSE's Nuclear Safety Directorate, senior officers of which have delegated regulatory and enforcement powers relating to nuclear site licensing under the NIA65 (see HSE above).
NuSAC	Nuclear Safety Advisory Committee - independent advisors on nuclear safety matters to HSC. Prior to mid 1997 NuSAC was known as the Advisory Committee on the Safety of Nuclear Installations (ACSNI).
OECD NEA	Organisation for Economic Cooperation and Development Nuclear Energy Agency

ORs	Operating Rules
OSART	Operational Safety Review Team
PCSR	Pre-construction Safety Report
POSR	Pre-operational Safety Report
PSA	Probabilistic Safety Assessment
PSR	Periodic Safety Review
PWR	Pressurised Water Reactor
QA	Quality Assurance
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations
RIMNET	Radiation Incident Monitoring Network
RPA	Radiological Protection Adviser
RPS	Radiological Protection Supervisor
RPV	Reactor Pressure Vessel
RSA93	Radioactive Substances Act 1993
SAPs	HSE's Safety Assessment Principles
SE	Scottish Executive
SEER	Scottish Executive Emergency Room
SEPA	Scottish Environment Protection Agency
SERAD	Scottish Executive Rural Affairs Department
SGLR	Senior Government Liaison Representative
SoS	Secretary of State
SPD	HSE's Safety Policy Directorate
SSR	Station Safety Report
STAR	Stop, Think, Act, Review concept
TCP	Town and Country Planning Act 1990
TOR	Tolerability of Risk
TQM	Total Quality Management
UK	United Kingdom of Great Britain and Northern Ireland
User Interface	The medium through which personnel obtain information about the plant and perform actions which impact upon plant behaviour
WANO	World Association of Nuclear Organisations
WENRA	Western European Regulators Association

List of Annexes Page

Annex 1 - Civil Nuclear Power Stations - Key Parameters

Nuclear Installation	Bradwell	Calder Hall	Chapel-cross	Dungeness A	Dungeness B	Hartlepool	Heysham 1	Heysham 2
Licensee	ME plc	BNF plc	BNF plc	ME plc	BEGL	BEGL	BEGL	BEGL
Reactor type	Magnox	Magnox	Magnox	Magnox	AGR	AGR	AGR	AGR
No. of reactors	2	4	4	2	2	2	2	2
1st power operation	1962	1956	1959	1965	1983	1983	1983	1988
Reactor thermal power (MWt)	538	270	265	840	1550	1500	1500	1600
Electrical gen. Power (MWe)	129	61	60	228	630	660	600	690
Sent off site MWe	123	50	50	220	570	615	550	625
Nuclear fuel Nuclear	U rod	U rod	U rod	U rod	UO2	UO2	UO2	UO2
Fuel Cladding	Magnox	Magnox	Magnox	Magnox	S. Steel	S. Steel	S. Steel	S. Steel
Nuclear moderator	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite
Reactor Core Fuel channels Assemblies per channel Rods/ assembly	 2837 8 -	 1696 6 -	 1696 6 -	 3932 7 -	 408 8 36	 324 8 36	 324 8 36	 332 8 36
Coolant	CO2	CO2	CO2	CO2	CO2	CO2	CO2	CO2
Coolant containment	Steel PV	Steel PV	Steel PV	Steel PV	PCPV	PCPV	PCPV	PCPV
Coolant pressure (Bar)	10	7	7	20	34	42	42	43
Coolant max. temp (C)	360	345	345	370	673	675	651	635
Steam turbine inlet press. (Bar)	54	15.5	15.5	25	163	163	163	163
Steam turbine inlet temp. (C)	355	321/193	329/185	370	555	538	538	538
Total Power Generated	246	244	240	440	1140	1230	1100	1260

Key:

BNF plc British Nuclear Fuels plc
MEplc Magnox Electric plc
BE(NEL) British Energy (Nuclear Electric Ltd)
BE(SN) British Energy (Scottish Nuclear Ltd)
U Rod Natural Uranium Rod
UO2 Enriched Uranium Oxide Pellet
Steel PV Welded Steel Pressure Vessel
PCPV Pre-stressed concrete pressure vessel

For AGRs there is one fuel assembly per channel of 8 elements and the table indicates the number of pins per element

Annex 1 - continued

Nuclear Installation	Hinkley Point B	Hunter-ston B	Oldbury-on Severn	Sizewell A	Sizewell B	Torness	Wylfa
Licensee	BEGL	BEG(UK)L	ME plc	ME plc	BEGL	BEG(UK)L	ME plc
Reactor type	AGR	AGR	Magnox	Magnox	PWR	AGR	Magnox
No. of reactors	2	2	2	2	1	2	2
1st power operation	1976	1976	1967	1966	1994	1988	1971
Reactor thermal power (MWt)	1494	1496	893	948	3411	1555	1875
Electrical gen. Power (MWe)	665	660	225	250	1256	682	550
Sent off site MW	622	624	217	210	1188	625	475
Nuclear fuel	UO2	U02	U rod	U	UO2	UO2	U
Fuel cladding	S.Steel	S.Steel	Magnox	Magnox	Zr-4	S.Steel	Magnox
Nuc. moderator	Graphite	Graphite	Graphite	Graphite	Water	Graphite	Graphite
Reactor Core Fuel channels Assemblies per channel Rods / channel	 308 8 36	 324 8 36	 3320 8 -	 3788 8 -	 - 193 264	 332 8 36	 6156 8 -
Coolant	CO2	CO2	CO2	CO2	Water	CO2	CO2
Coolant contain.	PCPV	PCPV	PCPV	Steel PV	Steel PV	PCPV	PCPV
Coolant pressure (Bar)	42	40	27	20	158	43.3	27.6
Coolant max. temp (C)	648	639	365	360	323	635	370
Steam turbine inlet press. (Bar)	160	163	27	46.6	67	160	35
Steam turbine inlet temp. (C)	495	538	350	354	283	538	320
Total Power Generated	1244	1248	434	420	1188	1250	950

Key:

BNF plc British Nuclear Fuels plc
BEGL British Energy Generation Ltd
U Rod Natural Uranium Rod
Steel PV Welded Steel Pressure Vessel
ME ltd Magnox Electric plc
BEG(UK)L Britsh Energy Generation (UK) Ltd
UO2 Enriched Uranium Oxide Pellet
PCPV Pre-stressed concrete pressure vessel

For AGRs there is one fuel assembly per channel of 8 elements and the table indicates the number of pins per element

Annex 2 - HSE's Powers under a Nuclear Site Licence

Consents - A Consent is required before the licensee can carry out any activity which is specifically identified in the licence. For example, consent is required before a reactor is allowed to be started up again following its periodic shutdown. Before being granted a Consent the licensee must satisfy HSE that the proposed action is safe and that all procedures necessary for control are in place.

Approvals - An Approval is used to freeze a licensee's arrangements. If HSE so specifies the licensee is required to submit the arrangements and cannot carry them out until HSE has given its approval. Once approved, the procedures cannot be changed without HSE's agreement, and the procedure itself must be carried out as specified; failure to do so would infringe the licence condition and would be an offence. For example, for nuclear power stations HSE has approved operating rules important to safety in order to ensure that licensees cannot change these without seeking HSE's agreement to the change.

Directions - A Direction is issued by HSE when it requires the licensee to take a particular action. For example, licence Condition 31(1) gives the Executive the power to Direct a licensee to shut down any plant, operation or process. Such a Direction would relate to a matter of major or immediate safety importance and has been used rarely.

Agreements - An Agreement issued by HSE allows a licensee, in accordance with its own arrangements, to proceed with an agreed course of action. For example, Licence Condition 22 requires a licensee to have adequate arrangements to control modifications to safety related plant. Such arrangements will often state that for modifications which, if inadequately conceived or implemented, there could be serious nuclear safety implications, the modification cannot be carried out without the agreement of HSE. Hence, the licensee submits a safety case justifying the modification and does not proceed until HSE has written agreeing to this proposal.

Notification - The standard licence gives HSE powers to request the submission of information by notifying the licensee of the requirement. For example in licence Condition 21(8) the licensee shall, if notified by the Executive, submit a safety case and shall not commence operation of the relevant plant or process without the consent of the Executive.

Specification - The standard licence gives HSE discretionary controls with regard to a licensee's arrangements and these are implemented through Specifications. For example, in licence condition 23(2), if the Executive specifies, the licensee is required to refer operating rules to its Nuclear Safety Committee for consideration.

Licence Instruments - Agreements, notifications, and specifications are all legally binding communications between HSE and the licensee which allow the licensee to carry out an activity or require some form of action to be taken. To administer these requests/authorisations, HSE has produced a standard form of letter known as a licence instrument.

Additional powers under the Health and Safety at Work etc. Act 1974

Improvement notice - The HSW Act provides (s.21) for an inspector, if of the opinion that a statutory provision is being or has been contravened (and the contravention will continue), to serve a notice requiring the person to remedy the contravention.

Prohibition notice - The HSW Act also provides (s.22) for an inspector, if of the opinion that activities are being carried out which risk causing serious personal injury, to serve a notice with immediate effect to prohibit the activity.

Annex 3 Extracts from the HSWA74 relevant to the CNS

Section 2 of the HSWA74 places the following duties on employers to their employees:

(1) It shall be the duty of every employer to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all his employees.

(2) Without prejudice to the generality of an employer's duty under the preceding subsection, the matters to which that duty extends include in particular -

(a) the provision and maintenance of plant and systems of work that are, so far as is reasonably practicable, safe and without risks to health;

(b) arrangements for ensuring, so far as is reasonably practicable, safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances;

(c) the provision of such information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of his employees;

(d) as far as is reasonably practicable as regards any place of work under the employer's control, the maintenance of it in a condition that is safe and without risks to health and the provision and maintenance of means of access to and egress from it that are safe and without such risks;

(e) the provision and maintenance of a working environment for his employees that is, so far as is reasonably practicable, safe, without risks to health, and adequate as regards facilities and arrangements for their welfare at work.

Under **Section 3** of the HSW Act employers have the following duties to persons other than their employees:

(1) It shall be the duty of every employer to conduct his undertaking in such a way as to ensure, so far as is reasonably practicable, that persons not in his employment who may be affected thereby are not exposed to risks to their health or safety.

(2) It shall be the duty of every self-employed person to conduct his undertaking in such a way as to ensure, so far as is reasonably practicable, that he and other persons (not being his employees) who may be affected thereby are not thereby exposed to risks to their health or safety.

(3) In such cases as may be prescribed, it shall be the duty of every employer and every self-employed person, in the prescribed circumstances and in the prescribed manner, to give to persons (not being his employees) who may be affected by the way in which he conducts his undertaking the prescribed information about such aspects of the way in which he conducts his undertaking as might affect their health or safety.

Section 7 of the HSWA74 places general duties on employees:

(a) to take reasonable care of the health and safety of himself and of other persons who may be affected by his acts or omissions at work; and

(b) as regards any duty or requirement imposed on his employer or any other person by or under any of the relevant statutory provisions, to co-operate with him so far as is necessary to enable that duty or requirement to be performed or complied with.

Section 8 places a duty on persons not to interfere with or misuse things provided pursuant to certain provisions:

'No person shall intentionally or recklessly interfere with or misuse anything provided in the interests of health, safety or welfare in pursuance of any of the relevant statutory provisions.'

Section 14 gives powers to investigate and make a special report on any accident, occurrence, situation or other matter.

Section 15 allows health and safety regulations to be made that:

{ repeal or modify any existing statutory provisions;

{ impose requirements for approval by a specified body or person;

{ provide for exemptions from any requirement or prohibition imposed by or under any of the relevant statutory provisions.

Section 16 allows, for the purpose of providing practical guidance on meeting the HSWA74 Regulations made under the Act and of the relevant statutory provisions, the issuing of codes of practice.

Section 19 allows the enforcing authority to appoint as inspectors such persons having suitable qualifications as it thinks necessary for carrying into effect the relevant statutory provisions within its field of responsibility. Every appointment of a person as an inspector must be made by an instrument in writing specifying which of the powers conferred on inspectors by the relevant statutory provision are to be exercisable by the person appointed.

Section 20 gives an inspector the following powers:

"(1) .... for the purpose of carrying into effect any of the relevant statutory provisions within the field of responsibility of the enforcing authority which appoints him, exercise the powers set out in subsection (2) below.

(2) ...., namely -
(a) at any reasonable time (or, in a situation which in his opinion is or may be dangerous, at any time) to enter any premises which he has reason to believe it is necessary for him to enter for the purpose mentioned in subsection (1) above;
(b) to take with him a constable if he has reasonable cause to apprehend any serious obstruction in the execution of his duty;
(c) without prejudice to the preceding paragraph, on entering any premises by virtue of (a) above to take with him -
(i) any other person duly authorised by his (the inspector's) enforcing authority; and
(ii) any equipment or materials required for any purpose for which the power of entry is being exercised;
(d) to make such examination and investigation as may in any circumstances be necessary for the purpose mentioned in subsection (1) above;
(e) as regards any premises which he has power to enter, to direct that those premises or any part of them, or anything therein, shall be left undisturbed (whether generally or in particular respects) for so long as is reasonably necessary for the purpose of any examination or investigation under paragraph (d) above;

(f) to take such measurements and photographs and make such recordings as he considers necessary for the purpose of any examination or investigation under paragraph (d) above;

(g) to take samples of any articles or substances found in any premises which he has power to enter, and of the atmosphere in or in the vicinity of any such premises;
(h) in the case of any article or substance found in any premises which he has power to enter, being an article or substance which appears to him to have caused or to be likely to cause danger to health or safety, to cause it to be dismantled or subjected to any process or test (but not so as to damage or destroy it unless this is in the circumstances necessary for the purpose mentioned in subsection (1) above);
(i) in the case of any such article or substance as is mentioned in the preceding paragraph, to take possession of it and detain it for so long as is necessary for all or any of the following purposes, namely -

(i) to examine it and do to it anything which he has power to do under that paragraph;
(ii) to ensure that it is not tampered with before his examination of it is completed;
(iii) to ensure that it is available for use as evidence in any proceedings for an offence under any of the relevant statutory provisions or any proceedings relating to a notice under section 21 or 22;

(j) to require any person whom he has reasonable cause to believe to be able to give any information relevant to any examination or investigation under paragraph (d) above to answer (in the absence of persons other than a person nominated by him to be present and any persons whom the inspector may allow to be present) such questions as the inspector thinks fit to ask and to sign a declaration of the truth of his answers;
(k) to require the production of, inspect, and take copies of or any entry in -

(i) any books or documents which by virtue of any of the relevant statutory provisions are required to be kept; and
(ii) any other books or documents which it is necessary for him to see for the purposes of any examination or investigation under paragraph (d) above;

(l) to require any person to afford him such facilities and assistance with respect to any matter or things within that person's control or in relation to which that person has responsibilities as are necessary to enable the inspector to exercise any of the powers conferred on him by this section;
(m) any other power which is necessary for the purpose mentioned in subsection (1) above."

Section 21 gives an inspector the power to serve improvement notices.

Section 22 gives an inspector the power to serve prohibition notices.

Section 25 gives an inspector the power to deal with cause of an imminent danger

Section 28 places restrictions on the disclosure of information.

Section 39 gives an inspector the power in England and Wales to prosecute before a magistrates' court proceedings for an offence under any of the relevant statutory provisions.

Annex 4 Extracts from the Nuclear Installations Act 1965 (as amended) relevant to the CNS

Sections 1, 3 to 6, 22 and 24A of the NIA65[7] are relevant statutory provisions of the HSWA74. The relevant parts of each of these sections to this Convention are:

Section 1 restricts certain nuclear installations to licensed sites:

"(1) Without prejudice to the requirements of any other Act, no person shall use any site for the purpose of installing or operating

(a) any nuclear reactor (other than such a reactor comprised in a means of transport, whether by land, water or air)

unless a licence so to do (a 'nuclear site licence') has been granted in respect of that site by the HSE and is for the time being in force."

Section 3 concerns the granting and variation of nuclear site licences:

"(1) A nuclear site licence shall not be granted to any person other than a body corporate and shall not be transferable.

(1A) The HSE shall consult the appropriate Agency [the Environment Agency (EA) in England and Wales and the Scottish Environment Protection Agency (SEPA) in Scotland] before granting a nuclear site licence in respect of a site in Great Britain.

(2) Two or more installations in the vicinity of one another may, if the HSE thinks fit, be treated for the purposes of the grant of a nuclear site licence as being on the same site.

(6) The HSE may from time to time vary any nuclear site licence by excluding therefrom any part of the licensed site -

(a) which the licensee no longer needs for any use requiring such a licence; and

(b) with respect to which the HSE is satisfied that there is no danger from ionising radiations from anything on that part of the site.

(6A) The HSE shall consult the appropriate Agency [EA or SEPA] before varying a nuclear site licence in respect of a site in Great Britain if the variation relates to or affects the creation, accumulation or disposal of radioactive waste, within the meaning of the Radioactive Substances Act 1993."

Section 4 allows HSE to attach conditions to licences:

"(1) The HSE by instrument in writing shall on granting any nuclear site licence, and may from time to time thereafter, attach to the licence such conditions as may appear to the HSE to be necessary or desirable in the interests of safety, whether in normal circumstances or in the event of any accident or other emergency on the site, which conditions may in particular include provision -

(a) for securing the maintenance of an efficient system for detecting and recording the presence and intensity of any ionising radiations from time to time emitted from anything on the site or from anything discharged on or from the site;

(b) with respect to the design, siting, construction, installation, operation, modification and maintenance of any plant or other installation on, or to be installed on, the site;

(c) with respect to preparations for dealing with, and measures to be taken on the happening of, any accident or other emergency on the site;

(d) without prejudice to Sections 13 and 16 of the Radioactive Substances Act 1993[12], with respect to the discharge of any substance on or from the site.

(2) The HSE may at any time by instrument in writing attach to a nuclear site licence such conditions as the HSE may think fit with respect to the handling, treatment and disposal of nuclear matter.

(3) The HSE may at any time by a further instrument in writing vary or revoke any condition for the time being attached to a nuclear site licence by virtue of this section.

(3A) HSE shall consult the appropriate Agency [EA or SEPA]

(a) before attaching any condition to a nuclear site licence in respect of a site in Great Britain or

(b) before varying or revoking any condition attached to such a nuclear site licence,

if the condition relates to or affects the creation, accumulation or disposal of radioactive waste, within the meaning of the Radioactive Substances Act 1993.

(5) At all times while a nuclear site licence remains in force, the licensee shall cause copies of any conditions for the time being in force under this section to be kept posted upon the site, and in particular on any part thereof which an inspector may direct, in such characters and in such positions as to be conveniently read by persons having duties upon the site which are or may be affected by those conditions."

Section 5 deals with the revocation and surrender of licences:

"(1) A nuclear site licence may at any time be revoked by the HSE or surrendered by the licensee.

(1A) HSE shall consult the appropriate Agency before revoking a nuclear site licence in respect of a site in Great Britain.

(2) Where a nuclear site licence has been revoked or surrendered, the licensee shall, if so required by the HSE, deliver up or account for the licence to such person as the HSE may direct, and shall during the remainder of the period of his responsibility cause to be kept posted upon the site such notices indicating the limits thereof in such positions as may be directed by an inspector; and the HSE may on revocation or surrender and from time to time thereafter until the expiration of the said period give to the licensee such other directions as the HSE may think fit for preventing or giving warning of any risk of injury to any person or damage to any property by ionising radiations from anything remaining on the site.

(3) In this Act, the expression 'period of responsibility' in relation to the licensee under a nuclear site licence means, as respects the site in question or any part thereof, the period beginning with the grant of the licence and ending with which ever of the following dates is the earlier, that is to say -

(a) the date when the HSE gives notice in writing to the licensee that in the opinion of the HSE there has ceased to be any danger from ionising radiations from anything on the site or, as the case may be, on that part thereof;

(b) the date when a new nuclear site licence in respect of a site comprising the site in question or, as the case may be, that part thereof is granted either to the same licensee or to some other person"

Section 6 refers to the maintenance of a list of licensed sites by the Secretary of State for Trade and industry.

Section 22 refers to reporting of and inquires into dangerous occurrences:

"(1) The provisions of this section shall have effect on the happening of any occurrence of any description as may be prescribed, being an occurrence -

(a) on a licensed site

(2) The licensee shall cause the occurrence to be reported forthwith in the prescribed manner to the HSE and to such other persons, if any, as may be prescribed in relation to occurrences of that class or description, and if the occurrence is not so reported the licensee shall be guilty of an offence."

Section 24A covers the recovery of expenses by the HSE.

Annex 5 - NUCLEAR SITE LICENCE: STANDARD LICENCE CONDITIONS

1: Interpretation

The purpose of Licence Condition (LC) 1 is to ensure that there is no ambiguity in the use of certain specified terms which are found in the text of the Conditions. It also contains important powers for the Executive to modify, revise or withdraw approvals, etc. and to approve modifications to any matter currently approved. Where appropriate reference is made back to the relevant statutory Acts of Parliament.

2: Marking of the Site Boundary

(1) The licensee shall make and implement adequate arrangements to prevent unauthorised persons from entering the site or, if so directed by the Executive, from entering such part or parts thereof as the Executive may specify.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The licensee shall mark the boundaries of the site by fences or other appropriate means, and any such fences or other means used for this purpose shall be properly maintained.
(5) The licensee shall, if so directed by the Executive, erect appropriate fences on the site in such positions as the Executive may specify and shall ensure that all such fences are properly maintained.

The purpose of LC 2 is to delineate the extent of the site in order to prevent unauthorised access in order to limit the risk of injury to intruders and to other persons or damage to their property.

3: Restriction on Dealing with the Site

The licensee shall not convey, assign, transfer, let or part with possession of the site or any part thereof or grant any licence in relation thereto without the consent of the Executive.

The purpose of LC 3 is to ensure that nothing confuses the absolute responsibility of the licensee under the NI Act in respect of safety on the whole licensed site. The licensee should be able to demonstrate that there are organisational procedures to prevent individuals within the company from conveying, assigning, transferring, letting, feuing or granting any licences in relation to the site or parts of the site without first obtaining the Consent of the Executive.

4: Restrictions on Nuclear Matter on the Site

(1) The licensee shall ensure that no nuclear matter is brought onto the site except in accordance with adequate arrangements made by the licensee for this purpose.
(2) The licensee shall ensure that no nuclear matter is stored on the site except in accordance with adequate arrangements made by the licensee for this purpose.
(3) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(4) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(5) For new installations, if the Executive so specifies, the licensee shall ensure that no nuclear matter intended for use in connection with the new installation is brought onto the site for the first time without the consent of the Executive.

The purpose of LC 4 is to ensure that the licensee carries out its responsibilities to control the introduction and storage of nuclear matter on the licensed site. (Nuclear matter being fuel, sources, radioactive waste, etc., as defined by the NI Act).

5: Consignment of Nuclear Matter

(1) The licensee shall not consign nuclear matter (other than excepted matter and radioactive waste) to any place in the United Kingdom other than a relevant site except with consent of the Executive.
(2) The licensee shall keep a record of all nuclear matter (including excepted matter and radioactive waste) consigned from the site and such record shall contain particulars of the amount, type and form of such matter, the manner in which it was packed, the name and address of the person to whom it was consigned and the date when it left the site.
(3) The licensee shall ensure that the aforesaid record is preserved for 30 years from the date of dispatch or such other period as the Executive may approve except in the case of any consignment or part thereof subsequently stolen, lost, jettisoned or abandoned, in which case the record shall be preserved for a period of 50 years from the date of such theft, loss, jettisoning or abandoning.

The purpose of LC 5 is to ensure that the transfer of nuclear matter, other than excepted matter and radioactive waste, to sites in the UK other than relevant sites:
(a) is carried out only with the consent of the Executive; and that
(b) the licensee has adequate records of where such nuclear matter has been sent.
The licensee should also be able to demonstrate that there are organisational procedures to prevent individuals from inadvertently consigning such matter to non-relevant sites without first obtaining a Consent from the Executive.
[Relevant sites are other licensed or Crown sites as defined in the NI Act and excepted matter is defined in the NI Act and Statutory Instrument (S.I.) 1965/1826 and S.I. 1978/1779].

6: Documents, Records, Authorities and Certificates

(1) The licensee shall make adequate records to demonstrate compliance with any of the conditions attached to this licence.
(2) Without prejudice to any other requirements of the conditions attached to this licence, the licensee shall make and implement adequate arrangements to ensure that every document required, every record made, every authority consent or approval granted and every direction or certificate issued in pursuance of the conditions attached to this licence is preserved for 30 years or such other periods as the Executive may approve.
(3) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(4) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(5) The licensee shall furnish to the Executive copies of any such document, record, authority or certificate as the Executive may specify.

The purpose of LC 6 is to ensure that adequate records are held by the licensee for a suitable period to demonstrate compliance with licence conditions.

7: Incidents on the Site

(1) The licensee shall make and implement adequate arrangements for the notification, recording, investigation and reporting of such incidents occurring on the site:
(a) as is required by any other condition attached to this licence;
(b) as the Executive may specify; and
(c) as the licensee considers necessary.

(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.

The purpose of LC 7 is to ensure that incidents are notified, recorded, investigated and reported as required by other licence conditions, as may be specified by the Executive and as the licensee considers necessary.

8: Warning Notices

The licensee shall ensure that suitable and sufficient notices are kept on the site for the purposes of informing persons thereon of each of the following matters, that is to say :
(a) the meaning of any warning signal used on the site;
(b) the location of any exit from any place on the site, being an exit provided for use in the event of an emergency;
(c) the measures to be taken by such persons in the event of fire breaking out on the site or in the event of any other emergency;
and that such notices are kept posted in such positions and in such characters as to be conveniently read by those persons.

The purpose of LC 8 is to ensure the safety of all people on site in respect of their ability to be able to respond appropriately and without delay to an emergency situation. The licensee therefore needs to ensure that all warning notices are in appropriate places to advise people on what to do in that area in the event of fire or any other emergency.

9: Instructions to Persons on the Site

The licensee shall ensure that every person authorised to be on the site receives adequate instructions (to the extent that is necessary having regard to the circumstances of that person being on the site) as regards the risks and hazards associated with the plant and its connection therewith and the action to be taken in the event of an accident or emergency on the site.

The purpose of LC 9 is to ensure that the licensee provides all persons allowed on the site with adequate instruction where necessary so that they are aware of the risks and hazards associated with the plant and its operations, the precautions that must be taken to minimise the risk to themselves and others and the actions to be taken in the event of an accident or emergency.

10: Training

(1) The licensee shall make and implement adequate arrangements for suitable training of all those on site who have responsibility for any operations which may affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration is made to the approved arrangements unless the Executive has approved such alteration or amendment.

The purpose of LC 10 is to ensure that all those people on the site who have responsibility for an action which may affect safety are adequately trained for that purpose. This Condition is in addition to the general duty under HSW Act s. 2(2)(c) and the IRRs, regulation 12(a).

11: Emergency Arrangements

(1) Without prejudice to any other requirements of the conditions attached to this licence the licensee shall make and implement adequate arrangements for dealing with any accident or emergency arising on the site and their effects.

(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) Where any such arrangements require the assistance or co-operation of, or render it necessary or expedient to make use of the services of any person, local authority or other body the licensee shall ensure that each person, local authority or other body is consulted in the making of such arrangements.
(5) The licensee shall ensure that such arrangements are rehearsed at such intervals and at such times and to such extent as the Executive may specify or, where the Executive has not so specified, as the licensee considers necessary.
(6) The licensee shall ensure that such arrangements include procedures to ensure that all persons in his employ who have duties in connection with such arrangements are properly instructed in the performance of the same, in the use of the equipment required and the precautions to be observed in connection therewith.

The purpose of LC 11 is to ensure that the licensee has adequate arrangements in place to respond effectively to any incident ranging from a minor on-site event to a significant release of radioactive material .

12: Duly Authorised and Other Suitably Qualified and Experienced Persons

(1) The licensee shall make and implement adequate arrangements to ensure that only suitably qualified and experienced persons perform any duties which may affect the safety of operations on the site or any duties assigned by or under these conditions or any arrangements required under these conditions.
(2) The aforesaid arrangements shall also provide for the appointment, in appropriate cases, of duly authorised persons to control and supervise operations which may affect plant safety.
(3) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(4) The licensee shall ensure that once approved no alteration is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(5) The licensee shall ensure that no person continues to act as a duly authorised person if, in the opinion of the Executive, he is unfit to act in that capacity and the Executive has notified the licensee to that effect.

The purpose of LC 12 is to ensure that only suitably qualified and experienced persons perform duties which may affect the safety of any operations on the site or any duties required by other licence conditions or their arrangements made thereunder.

13: Nuclear Safety Committee

(1) The licensee shall establish a nuclear safety committee or committees to which it shall refer for consideration and advice the following:
(a) all matters required by or under these conditions to be referred to a nuclear safety committee;
(b) such arrangements or documents required by these conditions as the Executive may specify and any subsequent alteration or amendment to such specified arrangements or documents;
(c) any matter on the site affecting safety on or off the site which the Executive may specify; and
(d) any other matter which the licensee considers should be referred to a nuclear safety committee.
(2) The licensee shall submit to the Executive for approval the terms of reference of any such nuclear safety committee and shall not form a nuclear safety committee without the aforesaid approval.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the terms of reference of such a nuclear safety committee unless the Executive has approved such alteration or amendment.
(4) The licensee shall appoint at least seven persons as members of a nuclear safety committee including one or more members who are independent of the licensee's operations and shall ensure that at least five members are present at each meeting including at least one independent member.
(5) The licensee shall furnish to the Executive the name, qualifications, particulars of current posts held and the previous relevant experience of every person whom he appoints as a member of any nuclear safety committee forthwith after making such appointment. Notwithstanding such appointment the licensee shall ensure that a person so appointed does not remain a member of any nuclear safety committee if the Executive

notifies the licensee that it does not agree to the appointment.
(6) The licensee shall ensure that the qualifications, current posts held and previous relevant experience of the members of any such committee, taken as a whole, are such as to enable that committee to consider any matter likely to be referred to it and to advise the licensee authoritatively and, so far as practicable, independently.
(7) The licensee shall ensure that a nuclear safety committee shall consider or advise only during the course of a properly constituted meeting of that committee.
(8) The licensee shall send to the Executive within 14 days of any meeting of any such committee a full and accurate record of all matters discussed at that meeting including in particular any advice given to the licensee.
(9) The licensee shall furnish to the Executive copies of any document or any category of documents considered at any such meetings that the Executive may specify.
(10) The licensee shall notify the Executive as soon as practicable if it is intended to reject, in whole or in part, any advice given by any such committee together with the reasons for such rejection.
(11) Notwithstanding paragraph (7) of this condition, where it becomes necessary to obtain consideration of or advice on urgent safety proposals (which would normally be considered by a nuclear safety committee) the licensee may do so in accordance with appropriate arrangements made for the purpose by the licensee, considered by the relevant nuclear safety committee and approved by the Executive.
(12) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements described in paragraph (11) of this condition unless the relevant nuclear safety committee has considered and the Executive has approved such alteration or amendment.

The purpose of LC 13 is to ensure that the licensee sets up a senior level committee which should consider and advise on matters which affect the safe design, construction, commissioning, operation and decommissioning of the installations on the licensed site and any other matter relevant to safety. The committee must have members who are adequately qualified to perform this task and to provide a source of authoritative advice to the licensee. The committee, however, is purely advisory and must not be considered to have an executive function, but the Executive must be informed if the advice of the committee is not to be followed by the licensee.

14: Safety Documentation

(1) Without prejudice to any other requirements of the condition attached to this licence the licensee shall make and implement adequate arrangements for the production and assessment of safety cases consisting of documentation to justify safety during the design, construction, manufacture, commissioning, operation and decommissioning phases of the installation.
(2) The licensee shall submit to the Executive for approval such parts or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment
(4) The licensee shall furnish to the Executive copies of any such documentation or any such category of documentation as the Executive may specify.

The purpose of LC 14 is to ensure that the licensee sets up arrangements for the preparation and assessment of the safety related documentation comprising "safety cases" to ensure that the licensee justifies safety during design, construction, manufacture, commissioning, operation, and decommissioning.

15: Periodic Review

(1) The licensee shall make and implement adequate arrangements for the periodic and systematic review and reassessment of safety cases.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The licensee shall, if so directed by the Executive, carry out a review and reassessment of safety and submit a report of such review to the Executive at such intervals, within such a period and for such of the matters or operations as may be specified in the direction.

The purpose of LC 15 is to ensure that the plant remains adequately safe and that the safety cases are kept up to date throughout its lifetime. The safety cases should be periodically reviewed in a systematic manner against the original design intent and current safety objectives and practices.

16: Site Plan, Designs and Specifications

(1) The licensee shall submit to the Executive an adequate plan of the site (hereinafter referred to as the site plan) showing the location of the boundary of the licensed site and every building or plant on the site which might affect safety.
(2) The licensee shall submit to the Executive with the site plan a schedule giving particulars of each building and plant thereon and the operations associated therewith.
(3) If any changes are made on the site which may affect the said buildings, plant or operations, the licensee shall forthwith send an amended site plan and schedule to the Executive incorporating these changes.
(4) The licensee shall furnish to the Executive such plans, designs, specifications or any other information relating to such buildings, plant and operations as the Executive may specify**.**

The purpose of LC 16 is to ensure that the licensee indicates, using a site plan, all buildings and plant or areas which might affect safety and provides a schedule updated as necessary giving details of each building and its associated operations.

17: Quality Assurance

(1) Without prejudice to any other requirements to the conditions attached to this licence the licensee shall make and implement adequate quality assurance arrangements in respect of all matters which affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The licensee shall furnish to the Executive such copies of records or documents made in connection with the aforesaid arrangements as the Executive may specify.

The purpose of LC 17 is to ensure that the licensee sets out the managerial and procedural arrangements that will be used to control and monitor those actions necessary in the interests of safety, and to demonstrate compliance with the site licence conditions (and in particular the arrangements made under them) and any other relevant legislation.

18: Radiological Protection

(1) The licensee shall make and implement adequate arrangements for the assessment of the average effective dose equivalent (including any committed effective dose equivalent) to such class or classes of persons as may be specified in the aforesaid arrangements and the licensee shall forthwith notify the Executive if the average effective dose equivalent to such class or classes of persons exceeds such level as the Executive may specify.
(2) The licensee shall submit to the Executive for approval such part or parts of the arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.

The purpose of LC 18 is to ensure that the licensee makes and implements adequate arrangements to assess the average effective dose equivalent to specified classes of persons. Also the licensee shall notify the Executive if such dose exceeds the specified level. This is complementary to the IRR, regulation 13.

19: Construction or Installation of New Plant

(1) Where the licensee proposes to construct or install any new plant which may affect safety the licensee shall make and implement adequate arrangements to control the construction or installation.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The aforesaid arrangements shall where appropriate divide the construction or installation into stages. Where the Executive so specifies the licensee shall not commence nor thereafter proceed from one stage to the next of the construction or installation without the consent of the Executive. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of the proposed construction or installation and shall where appropriate provide for the submission of this documentation to the Executive.
(5) The licensee shall, if so directed by the Executive, halt the construction or installation of a plant and the licensee shall not recommence such construction or installation without the consent of the Executive.

The purpose of LC 19 is to ensure that the licensee provides and implements adequate control over the construction and installation of new plant which may affect safety.

20: Modification to Design of Plant under Construction

(1) The licensee shall ensure that no modification to the design which may affect safety is made to any plant during the period of construction except in accordance with adequate arrangements made and implemented by the licensee for that purpose.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The aforesaid arrangements shall provide for the classification of modifications according to their safety significance. The arrangements shall where appropriate divide modifications into stages. Where the Executive so specifies the licensee shall not commence nor thereafter proceed from one stage to the next of the modification without the consent of the Executive. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of the proposed modification and shall where appropriate provide for the submission of this documentation to the Executive.

The purpose of LC 20 is to ensure that where necessary adequate arrangements exist to control safety-related modifications during design and construction of plant or process.

21: Commissioning

(1) The licensee shall make and implement adequate arrangements for the commissioning of any plant or process which may affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration and amendment.
(4) The aforesaid arrangement shall where appropriate divide the commissioning into stages. Where the Executive so specifies the licensee shall not commence nor thereafter proceed from one stage to the next of the commissioning without the consent of the Executive. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of the proposed commissioning and shall where appropriate provide for the submission of this documentation to the Executive.
(5) The licensee shall appoint a suitably qualified person or persons for the purpose of controlling, witnessing, recording and assessing the results of any tests carried out in accordance with the requirements of the aforesaid commissioning arrangements.
(6) The licensee shall ensure that full and accurate records are kept of the results of every test and operation carried out in pursuance of this condition.

(7) The licensee shall ensure that no plant or process which may affect safety is operated (except for the purpose of commissioning) until:

(a) the appropriate state of commissioning has been completed and a report of such commissioning, including any results and assessments of any tests as may have been required under the commissioning arrangements referred to in paragraph (1) of this condition, has been considered in accordance with those arrangements; and

(b) a safety case or cases as appropriate, which shall include the safety implications of modifications made since the commencement of construction of the plant and those arising from the commissioning of the plant, and any matters whereby the operation of the plant may be effected by such modifications or commissioning, has been considered in accordance with the arrangements referred to in paragraph (1) of this condition.

(8) The licensee shall, if so notified by the Executive, submit to the Executive the safety case for the aforesaid plant or processes prepared in pursuance of paragraph (7) of this condition and shall not commence operation of the relevant plant or process without the consent of the Executive.

The purpose of LC 21 is to ensure that adequate arrangements exist for the commissioning of a new or modified plant or process which may affect safety and to ensure qualified supervision of this work.

22: Modification or Experiment on Existing Plant

(1) The licensee shall make and implement adequate arrangements to control any modification or experiment carried out on any part of the existing plant or process which may affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The aforesaid arrangements shall provide for the classification of modifications or experiments according to their safety significance. The arrangements shall where appropriate divide the modification or experiment into stages. Where the Executive so specifies the licensee shall not commence nor thereafter proceed from one stage to the next of the modification or experiment without the consent of the Executive. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of the proposed modification or experiment and shall where appropriate provide for the submission of the documentation to the Executive.
(5) The licensee shall if so directed by the Executive, halt the modification or experiment and the licensee shall not recommence such modification or experiment without the consent of the Executive.

The purpose of LC 22 is to ensure that adequate arrangements exist to ensure that all modifications and experiments that may affect safety are adequately controlled.

23: Operating Rules

(1) The licensee shall, in respect of any operation that may affect safety, produce an adequate safety case to demonstrate the safety of that operation and to identify the conditions and limits necessary in the interests of safety. Such conditions and limits shall hereinafter be referred to as operating rules.
(2) The licensee, where the Executive so specifies, shall refer the operating rules arising from paragraph (1) of this condition to the relevant nuclear safety committee for consideration.
(3) The licensee shall ensure that operations are at all times controlled and carried out in compliance with such operating rules. Where the person appointed by the licensee for the purposes of condition 26 identifies any matter indicating that the safety of any operation or the safe condition of any plant may be affected that person shall bring that matter to the attention of the licensee forthwith who shall take appropriate action and ensure the matter is then notified, recorded, investigated and reported in accordance with arrangements made under condition 7.
(4) The licensee shall submit to the Executive for approval such of the aforesaid operating rules as the Executive may specify.

(5) The licensee shall ensure that once approved no alteration or amendment is made to any approved operating rule unless the Executive has approved such alteration or amendment.

(6) Notwithstanding the preceding provisions of this condition the Executive may, if in its opinion circumstances render it necessary at any time, agree to the temporary suspension of any approved operating rule.

The purpose of LC 24 is to ensure that all operations that may affect safety are supported by a safety case. Also that the safety case identifies the conditions and limits that ensure that the plant is kept in a safe condition.

24: Operating Instructions

(1) The licensee shall ensure that all operations which may affect safety are carried out in accordance with written instructions hereinafter referred to as operating instructions.
(2) The licensee shall ensure that such operating instructions include any instructions necessary in the interests of safety and any instructions necessary to ensure that any operating rules are implemented.
(3) The licensee shall, if so specified by the Executive, furnish to the Executive copies of such operating instructions and when any alteration is made to the operating instructions furnished to the Executive, the licensee shall ensure that such alteration is furnished to the Executive within such time as may be specified.
(4) The licensee shall make and implement adequate arrangements for the preparation, review and amendment of such operating instructions.
(5) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(6) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.

The purpose of LC 24 is to ensure that all operations as defined in Condition 1 which may affect safety, including any instructions to implement Operating Rules, are undertaken in accordance with written operating instructions.

25: Operational Records

(1) The licensee shall ensure that adequate records are made of the operation, inspection and maintenance of any plant which may affect safety.
(2) The aforesaid records shall include records of the amount and location of all radioactive material, including nuclear fuel and radioactive waste, used and processed, stored or accumulated upon the site at any time.
(3) The licensee shall record such additional particulars as the Executive may specify.
(4) The licensee shall furnish to the Executive such copies of extracts from such records as the Executive may specify.

The purpose of LC 25 is to ensure that adequate records are kept regarding operation, inspection and maintenance of any safety-related plant.

26: Control and Supervision of Operations

The licensee shall ensure that no operations are carried out which may affect safety except under the control and supervision of suitably qualified and experienced persons appointed for that purpose by the licensee.

The purpose of LC 26 is to ensure that safety-related operations are carried out only under the control and supervision of suitably qualified and experienced personnel.

27: Safety Mechanisms, Devices and Circuits

The licensee shall ensure that a plant is not operated, inspected, maintained or tested unless suitable and sufficient safety mechanisms, devices and circuits are properly connected and in good working order.

The purpose of LC 27 is to ensure that plant is not used unless safety mechanisms, devices and circuits are

installed and maintained to an adequate standard.

28: Examination, Inspection, Maintenance and Testing

(1) The licensee shall make and implement adequate arrangements for the regular and systematic examination, inspection, maintenance and testing of all plant which may affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The aforesaid arrangements shall provide for the preparation of a plant maintenance schedule for each plant. The licensee shall submit to the Executive for its approval such part or parts of any plant maintenance schedule as the Executive may specify.
(5) The licensee shall ensure that once approved no alteration or amendment is made to any approved part of any plant maintenance schedule unless the Executive has approved such alteration or amendment.
(6) The licensee shall ensure in the interests of safety that every examination, inspection, maintenance and test of a plant or any part thereof is carried out:

(a) by suitably qualified and experienced persons;
(b) in accordance with schemes laid down in writing;
(c) within the intervals specified in the plant maintenance schedule; and
(d) under the control and supervision of a suitably qualified and experienced person appointed by the licensee for that purpose.

(7) Notwithstanding the above paragraph of this condition the Executive may agree to an extension of any interval specified in the plant maintenance schedule.
(8) When any examination, inspection, maintenance or test of any part of a plant reveals any matter indicating that the safe operation or safe condition of that plant may be affected, the suitably qualified and experienced person appointed to control and supervise any such examination, inspection, maintenance or test shall bring it to the attention of the licensee forthwith who shall take appropriate action and ensure that the matter is then notified, recorded, investigated and reported in accordance with the arrangements made under condition 7.
(9) The licensee shall ensure that a full and accurate report of every examination, inspection, maintenance or test of any part of a plant indicating the date thereof and signed by the suitably qualified and experienced person appointed by the licensee to control and supervise such examination, inspection, maintenance or test is made to the licensee forthwith upon completion of the said examination, inspection, maintenance or test.

The purpose of LC 28 is to ensure that all plant that may affect safety is scheduled to receive regular and systematic examination, inspection, maintenance and testing, by and under the control of suitable personnel.

29: Duty to carry out Tests and Inspections

(1) The licensee shall carry out such tests, inspections and examinations in connection with any plant (in addition to any carried out under condition 28 above) as the Executive may , after consultation with the licensee, specify.
(2) The licensee shall furnish the results of any such tests, inspections and examinations carried out in accordance with paragraph (1) of this condition to the Executive as soon as practicable.

The purpose of LC 29 is to enable the Executive, following consultation, to require the licensee to perform any tests, inspections and examinations which it may specify, and to be provided with the results.

30: Periodic Shutdown

(1) When necessary for the purpose of enabling any examination, inspection, maintenance or testing of any plant or process to take place, the licensee shall ensure that any such plant or process shall be shut down in accordance with the requirements of its plant maintenance schedule referred to in condition 28.
(2) Notwithstanding paragraph (1) of this condition the Executive may agree to an extension of a plant's operating period.
(3) The licensee shall, if so specified by the Executive, ensure that when a plant or process is shut down in pursuance of paragraph (1) of this condition it shall not be started up again thereafter without the consent of the Executive.

The purpose of LC 30 is to ensure that any part of the plant or process shall, where necessary to allow examination, inspection, maintenance and testing to take place, be shut down in accordance with the plant maintenance schedule. The Executive has discretion to require its consent to start-up of any process shut down under this condition.

31: Shutdown of Specific Operations

(1) The licensee shall if so directed by the Executive shut down any plant, operation or process on the site within such period as the Executive may specify.
(2) The licensee shall ensure that when the plant, operation or process is shut down in pursuance of paragraph 1 of this condition it shall not be started up without the consent of the Executive.

The purpose of LC 31 is to give discretionary powers to the Executive to shut down any plant, operation or process within a given period and to require its consent to start-up of any plant, operation or process shut down under this condition.

32: Accumulation of Radioactive Waste

(1) The licensee shall make and implement adequate arrangements for minimising so far as is reasonably practicable the rate of production and total quantity of radioactive waste accumulated on the site at any time and for recording waste so accumulated.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) Without prejudice to paragraph (1) of this condition the licensee shall ensure that radioactive waste accumulated or stored on the site complies with such limitations as to quantity, type and form as may be specified by the Executive.
(5) The licensee shall, if so specified by the Executive, not accumulate radioactive waste except in a place and in a manner approved by the Executive.

The purpose of LC 32 is to ensure that the production rate and accumulation of radioactive waste on the site is minimised, held under suitable storage arrangements and that adequate records are made.

33: Disposal of Radioactive Waste

The licensee shall, if so directed by the Executive, ensure that radioactive waste accumulated or stored on the site is disposed of as the Executive may specify and in accordance with an Authorisation granted under the Radioactive Substances Act 1960 or, as the case may be, the Radioactive Substances Act 1993.

The purpose of LC 33 is to give discretionary powers to the Executive to direct that radioactive waste be disposed of in a specified manner. This is related to the powers available to the EA in England and Wales and SEPA in Scotland under of the Radioactive Substances Act 1993, s. 13.

34: Leakage and Escape of Radioactive Material and Radioactive Waste

(1) The licensee shall ensure, as far as is reasonably practicable, that radioactive material and radioactive waste on the site is at all times adequately controlled or contained so that it cannot leak or otherwise escape from such control or containment.
(2) Notwithstanding paragraph (1) of this condition the licensee shall ensure, so far as is reasonably practicable, that no such leak or escape of radioactive material or radioactive waste can occur without being detected, and that any such leak or escape is then notified, recorded, investigated and reported in accordance with arrangements made under condition 7.
(3) Nothing in this condition shall apply to discharges or releases of radioactive waste in accordance with an approved operating rule or with disposal authorisation granted under the Radioactive Substances Act 1960 or, as the case may be, the Radioactive Substances Act 1993.

The purpose of LC 34 is to ensure so far as reasonably practicable that radioactive material and radioactive waste is adequately controlled or contained so as to prevent leaks or escapes, and that any unauthorised leak or escape can be detected and reported.

35: Decommissioning

(1) The licensee shall make and implement adequate arrangements for the decommissioning of any plant or process which may affect safety.
(2) The licensee shall make arrangements for the production and implementation of decommissioning programmes for each plant.
(3) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements or programmes as the Executive may specify.
(4) The licensee shall ensure that once approved no alteration or amendment is made to the arrangements or programmes unless the Executive has approved such alteration or amendment.
(5) The aforesaid arrangements shall where appropriate divide the decommissioning into stages. Where the Executive so specifies the licensee shall not commence nor thereafter proceed from one stage to the next of the decommissioning without the consent of the Executive. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of the proposed decommissioning and shall where appropriate provide for the submission of this documentation to the Executive.
(6) The licensee shall, if so directed by the Executive where it appears to them to be in the interests of safety, commence decommissioning in accordance with the aforesaid arrangements and decommissioning programmes.
(7) The licensee shall, if so directed by the Executive, halt the decommissioning of a plant and the licensee shall not recommence such decommissioning without the consent of the Executive.

The purpose of LC 35 is to require the licensee to make adequate provisions for decommissioning. It also gives discretionary powers to the Executive to direct that decommissioning of any plant or process be commenced or halted.

36: Control of Organisational Change

(1) The licensee shall make and implement adequate arrangements to control any change to its organisational structure or resources which may affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The aforesaid arrangements shall provide for the classification of changes to the organisational structure or resources according to their safety significance. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of any proposed change and shall where appropriate provide for the submission of such documentation to the Executive.
(5) The licensee shall if so directed by the Executive halt all change to its organisational structure or resources and the licensee shall not recommence such change without the consent of the Executive.

ANNEX 6 Regulatory Organisations

A6.1 This Annex provides further information to that supplied in Article 8 on the regulators that enforce health, safety and environmental regulation in the UK.

Health and Safety Regulation

Health and Safety Executive

(i) Mandate and Duties

Nuclear Installations Inspectorate (NII)

A6.2 The original Nuclear Installations Act, enacted in 1959, set up the NII, then called the Inspectorate of Nuclear Installations, in 1960. The 1959 Act was subsequently replaced by the NIA65[7] that, though amended in some details, retains essentially the same regulatory powers. In 1975, NII was incorporated into HSE and now forms part of HSE's NSD. Those parts of NIA65 relating to licensing became relevant statutory provisions of HSWA74.

A6.3 NII operates the nuclear site licensing system under NIA65 on behalf of HSE. NII grants licences to corporate bodies to install or operate nuclear installation on a particular site. NII on behalf of HSE, may attach to a nuclear site licence such conditions as appear necessary or desirable in the interest of safety, or such conditions as it may think fit with respect to the handling, treatment and disposal of nuclear matter.

A6.4 NSD is organised into four Divisions. Divisions 1-3 are the main operational Divisions which carry out the day-to-day regulation and each has the inspection, technical and administrative resources relevant to their dealings with a particular licensee or group of licensees. They employ specialists in such areas as civil engineering, human factors, structural integrity, health physics, radioactive waste management, decommissioning, management of safety, and mechanical engineering. Division 4 is responsible for nuclear safety research, regulatory strategy and the Directorate administrative support system. Each Division also has administrative and Information Technology (IT) support. An outline of this structure can be seen below in Fig. A6.1.

Fig. A6.1 Structure of NSD, the Nuclear Safety Regulator

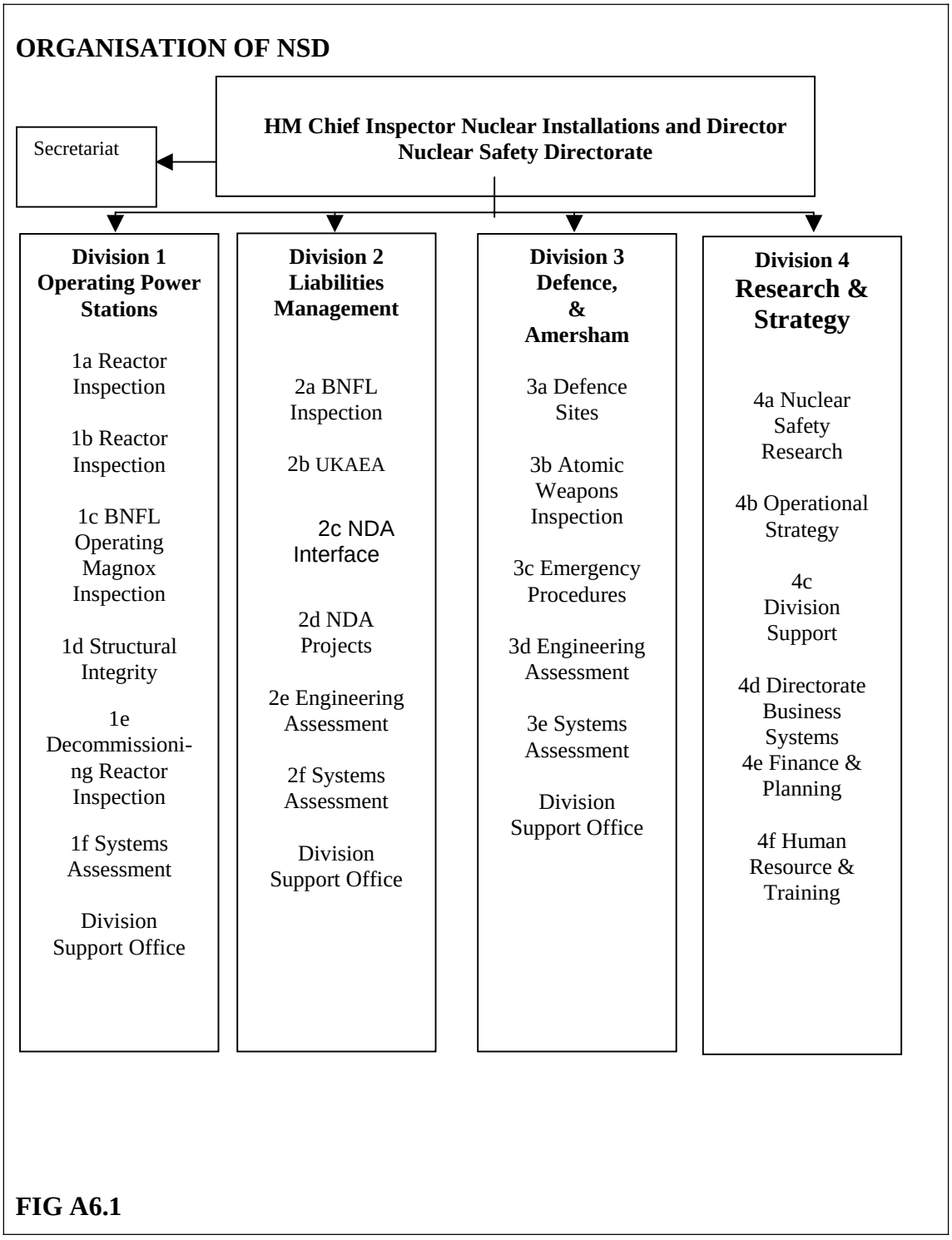


FIG A6.1

(iii) Financial Resources

A6.5 NSD is funded through HSE, which is a "non departmental public body", sponsored in Parliament by the Department for Work and Pensions (DWP). HSE is funded by Parliament, through grant-in-aid. NIA65 requires HSE to recover its 'expenses' from nuclear licensees for regulatory work in support of the licensing regime. HSE is required to operate a gross accounting arrangement and receipts from charges are treated as appropriation-in-aid. Parliament, through the Spending Review, sets the overall level of HSE's expenditure and therefore its receipts.

A6.6 The principle charges applied to nuclear licensees fall under the provisions of the NIA65. NSD determines the exact amount to be recovered, in total, from the licensees and then, on the basis of the amount of regulatory effort each has consumed, apportions charges to each licensee. Therefore, if a licensee consumes 10% of the NII's effort, they will be charged 10% of its expenses.

A6.7 These charges are not for the provision of a "service" to the licensee; they are analogous to taxation. HSE also applies a Levy to the major nuclear licensees, in order to recover its expenses applied to the Nuclear Safety Research Programme.

A6.8 In 2004/05 NII's total expenditure forecast is £20 million (excluding central HSE overheads).

(iv) Human Resources

A6.9 For the efficient and effective delivery of its work, NII relies upon qualified and well trained staff from within NSD and from other parts of HSE; also upon external sources of expert support and the results of research, and information exchange with other countries.

A6.10 On 1 January 2004 NSD employed 268 staff. This included 169 inspector and technical staff and 99 administrative staff. All are based at Bootle in Merseyside.

(v) Inspectors' Qualifications

A6.11 All of NSD inspectors are technically qualified, educated to degree level and have at least 5-7 years experience in industry in a responsible position. Most are members of recognised professional institutions. They carry out site inspection or specialist/safety case assessment roles, delivering the regulatory functions required by the Health and Safety at Work Act and nuclear legislation.

(vi) Inspectors' training

GS-R-1 .4.7: In order to ensure that the proper skills are acquired and that adequate levels of competence are achieved and maintained, the regulatory body shall ensure that its staff members participate in well defined training programmes.

A6.12 All new NSD staff receives a range of induction training. For inspectors it includes, within 12-18 months of their appointment, specific training to develop the skills and attitudes necessary to become an effective regulator. Linked activity includes several mandatory courses. For example:

- some modules of a Diploma in Occupational Health and Safety;

- familiarisation with IRR99;
- an introduction to health and safety law, relevant nuclear regulation and nuclear licence compliance;
- understanding the assessment of safety cases;
- awareness of radiological protection;
- awareness of personal safety on site.

A6.13 In addition to the mandatory courses identified above, all new inspectors receive on-the-job support. Many shadow experienced staff to benefit from the practical guidance that they can offer. Examples include participating in emergency exercises and being part of team inspections at nuclear sites.

GS-R-1 .4.8: The regulatory body shall have a full time staff capable of either performing regulatory reviews and assessments, or evaluating any assessments performed for it by consultants.

A6.14 Once through the 12–18 month induction period, Continuous Professional Development (CPD) provides for the on-going training and development of NSD staff - especially for the technical training of nuclear safety regulators. Opportunities are provided to help regulatory staff develop in their discipline or specialist area or to acquire new skills after a change of duties, examples are: NSD runs its own Site Inspection Course for all regulators new to, or returning to, site inspection duties, and arranges for full-scale reactor simulator training to refresh the skills of reactor inspectors and assessors. Inspectors can also attend externally organised courses/ conferences both in the UK and abroad. Such events are usually designed to keep delegates abreast of the latest technological developments and ways of working in the nuclear and other high hazard industries. A range of non-technical training is also provided for management and personal development, examples include leadership training; effective management, team working; effective communication, and stress awareness workshops.

A6.15 As a further strand of CPD, each year there is a strategic overview of staffing and positioning of expertise in relation to delivery of the short-medium term business objectives. This is known as the Career Development Review process. Its aim is to ensure that NSD continues to have the right expertise, in the right place, at the right time to enable it to sustain delivery of its mission; and wherever possible, to achieve this by meeting individuals' development goals.

A6.16 NSD senior management also review the Training and Development Plan each year; they are particularly concerned to see the impact that their investment in training and development has had on the delivery of NSD's business. On average, that budget runs at around £250k per annum for the direct cost of off-job training activity; and when on-job activity is added the cost increases to about £750k per annum, with a significant proportion invested in the technical training and development of inspectors.

GS-R-1 .4.3: If the regulatory body is not entirely self-sufficient in all the technical or functional areas necessary to discharge its responsibilities for review and assessment or inspection, it shall seek advice or assistance, as appropriate, from consultants.

A6.17 The 'expenses' recovered from licensees include the two major cost streams of expenditure associated with the NII's own operational activity (payroll, travel and

subsistence, training and other staff related costs) and the costs of Nuclear Safety Studies (which enables NII to buy-in technical and scientific support in support of the regulatory function).

GS-R-1 3.2: In fulfilling its statutory obligations, the regulatory body:
(3) … shall specify (unless elsewhere specified):
(i) the facilities, activities or inventories of sources covered by the [licence]

A6.18 LC16 ensures the licensee indicates, using a site plan, all buildings and plant or areas that might affect safety and provides a schedule updated as necessary giving details of each building and its associated operations. This is to ensure that not only does the licensee understand the content and function of all safety related buildings on his site, but it also enables HSE to inspect the adequacy of activities and storage conditions across the site. The specification of facilities and activities covered by a nuclear site licence arises from the process of licensing itself. The assessment of an application for a nuclear site licence falls under three broad areas - the organisation, the location and the activities. Each of these areas is considered below.

The Organisation

A6.19 Before granting a licence the HSE must be satisfied that the applicant is to be the user of the installation and has an adequate management structure and resources to discharge the obligations and liabilities connected with having a nuclear site licence. The type of organisation and level of resource needs to be commensurate with the risk. An applicant demonstrates using a management prospectus showing:

- lines of authority leading to adequate control of activities whether by the licensee's own staff or contractors;
- adequate staff resources;
- precise definition and documentation of duties;
- integration of health and safety responsibilities into job functions;
- appropriately trained experienced staff ensuring adequate in-house expertise; and
- the provision of, or access to, a high level of health and safety expertise used in an active role for the peer review of the safety case, audit and review;

A6.20 The management prospectus is also the part of a licensee's safety case that deals with management issues. By this means HSE is looking for a clear statement about a company, its structure and how it proposes to operate. The management prospectus should therefore include:

- safety policy statement;
- company organisation, management structure and resources including an estimate of its lifetime;
- the basis for corporate health and safety standards;
- proposals for providing health and safety services including:

- safety case production (including modifications);
- peer review of safety cases;
- provision of independent advice to line management, e.g. Nuclear Safety Committee;
- safety audit and inspection;

- description of liabilities or decommissioning assumed by the new licensee;
- provisions for financing continuing liabilities and decommissioning;
- proposals for, and anticipated extent of, the use of contractors; and
- leasing arrangements for land and/or plant.

A6.21 Note that a licensee has responsibility for the safe operation of an installation and absolute liability for injury to persons or damage to property under NIA65. It is therefore important that no doubt exists about the identity of the corporate body having this duty.

The Location

A6.22 The main safeguard to the public from the risks arising from the operation of an installation is the high standard of design and its safe operation. Although a major accident is extremely unlikely it is prudent to consider the number of people who may be exposed to its consequences. For new sites HSE will expect the licensee to submit details of present and predicted population around the site out to 30km for reactors but to a lesser distance for minor plants. Information on nearby schools, industry, hospitals, institutions and other places where people may congregate will be sought. HSE will assess this information against its criteria and will expect to see an allowance for natural population growth around the site over time.

A6.23 For reasons similar to those given when discussing the organisation to be licensed, it is important that the licensed site is defined clearly. The extent of the site must encompass the licensable activities and allow a sufficient margin for the maintenance of plant or buildings. The boundary should:

(a) be obvious and permanent, e.g. it should ideally not be across water;

(b) avoid so far as is practicable passing through a building, and in particular, avoid being 3-dimensional, i.e. the boundary should be a simple vertical limit; and

(c) wherever practicable encompass all underground workings.

A6.24 For a licensee to exercise control over a site requires adequate security of tenure. It is preferable for a licensee to own the site on which an installation is to be constructed but this is not essential. Any lease will need to be for the anticipated lifetime of the site, including decommissioning. Hence 99 years is the norm although particular circumstances may require a longer period.

A6.25 An application may relate to a previously licensed site but exclude a part of that site which is no longer required for activities requiring a licence. The applicant will therefore be seeking to end the "period of responsibility" for that part of the site. In these circumstances written justification for exclusion will be necessary, together with radiological data in support of the contention that there is no longer any danger from ionising radiations from anything on that part of the site.

The Activities

A6.26 The power to grant nuclear site licences is limited to the types of installation described in the section "Licensable Activities". The nature and extent of the assessment of the design of an installation will depend on whether the plant is of an established or new type. The standards of safety that the Executive expects a licensee to demonstrate in nuclear plant design are expressed in the SAPs [24]. HSE will assess proposals against this guidance.

A6.27 There are no formal rules or procedures for the processes, which lead to and follow the grant of a Nuclear Site Licence. However, as an example, the following may be regarded as a typical sequence of events for a new site for a power reactor.

A6.28 Safety guidelines for the station design prepared by the licence applicant must be acceptable to NII before a safety case for the design can be considered. The licence applicant usually maintains discussions with HSE during the development of the safety case. As aspects of the design reach the point where their safety can be assessed submissions are made to HSE. These submissions may be discussed and further analysis or design modifications may be necessary before HSE acceptance. Major submissions may include the following:

(a) a reference design that includes an initial statement of design and the safety criteria to be applied;

(b) a preliminary safety report to show, in principle, the means by which the reference design can meet the applicant's safety criteria;

(c) a pre-construction safety report that is a more comprehensive statement on safety analysis;

(d) proposed research and development work in support of the safety case;

(e) proposals for quality assurance to ensure that design, manufacture, inspection and construction are carried out reliably to the required standard; and

(f) a contract design, which is the design intended for construction.

A6.29 To help assess the applicant's submissions HSE may seek independent data and advice from external sources.

A6.30 With respect to inventories of radioactive material covered by the licence, LC 4 is to ensure that the licensee carries out its responsibilities to control the introduction and storage of nuclear matter on the licensed site. (Nuclear matter being fuel, sources, radioactive waste, etc., as defined by the NI Act). In addition, LC 5 is to ensure that the transfer of nuclear

matter, other than excepted matter and radioactive waste, to sites in the UK other than relevant sites:

(a) is carried out only with the consent of the Executive; and that

(b) the licensee has adequate records of where such nuclear matter has been sent.

A6.31 The licensee should also be able to demonstrate that there are organisational procedures to prevent individuals from inadvertently consigning such matter to non-relevant sites without first obtaining a Consent from the Executive. Relevant sites are other licensed or Crown sites as defined in the NI Act and excepted matter is defined in the NI Act and S.I. 1965/1826 and S.I. 1978/1779.

GS-R-1 3.2: In fulfilling its statutory obligations, the regulatory body: (3) … shall specify (unless elsewhere specified): (ii) the requirements for notifying the regulatory body of any modifications to safety related aspects;

A6.32 LC20 ensures the licensee cannot change the design of an installation once HSE has given its consent or agreement to construction without going through a proper design change process which assesses the modification in relation to its safety significance and defines the degree of safety justification required. The condition gives HSE the power to intervene and stop a modification if it believes there is inadequate safety justification.

A6.33 Many accidents across all industries have been caused by modifications to operating plant or changes to processes that have not been adequately assessed. LC22 ensures the licensee has adequate arrangements to control all modifications to its installations on a licensed site that may affect safety. The condition also gives HSE the power to control such modifications to ensure that they cannot commence until the licensee has adequately demonstrated the safety of the proposal. These powers can be direct or indirect via the licensee's own voluntary hold points. This condition also gives HSE the power to halt a modification or intervene at any stage in the interest of safety.

GS-R-1 3.2: In fulfilling its statutory obligations, the regulatory body: (3) … shall specify (unless elsewhere specified): (iv) any limits on operation and use;

A6.34 The safe operation of a nuclear installation results from many factors including the design of the plant, its behaviour under fault or accident conditions and the functions of the operators. It is therefore essential that the totality of these interactions that are often complex are fully understood. The method of doing this is to require the operator to produce a safety case to justify the operation of the installation. The purpose of LC23 is to ensure that the licensee produces such a safety case and that it identifies all the necessary conditions and limits that ensure that the plant is kept within parameters which ensure the safety of the plant during normal operation and fault and accident conditions.

A6.35 The safety of a nuclear installation is influenced by the actions of people who control, maintain or service the plant. It is important given the often complex nature of the safety case for all actions carried out by people to be done in accordance with procedures derived from the safety case. It is also important that actions are not carried out on an ad hoc basis without written evidence. Therefore LC24 ensures all operations as defined in LC1 that may affect safety, including any instructions to implement Operating Rules, are undertaken in accordance with written operating instructions.

GS-R-1 3.2 In fulfilling its statutory obligations, the regulatory body: (3) … shall specify (unless elsewhere specified): (vii) the requirements for incident reporting;

A6.36 LC7 ensures that the licensee has adequate arrangements to deal with incidents that may occur on the nuclear licensed site. It also requires the licensee to keep a record of all such incidents, notify the HSE when appropriate, investigate the cause of each incident and produce a report of the investigation to ensure that lessons are learnt.

GS-R-1 3.2: In fulfilling its statutory obligations, the regulatory body: (3) … shall specify (unless elsewhere specified): (viii) the reports that the operator is required to make to the regulatory body;

A6.37 Various LCs require the licensee to make reports to HSE. Where this occurs it becomes part of the licensee's arrangements, which once agreed with HSE cannot be changed without HSE's approval.

GS-R-1 3.2: In fulfilling its statutory obligations, the regulatory body: (3) … shall specify (unless elsewhere specified): (ix) the records that the operator is required to retain and the time periods for which they must be retained;

A6.38 LC6 ensures adequate records are held by the licensee for a suitable period to ensure that the safety case for operation is available at all times, design and construction information is available for decommissioning, operational records are available to assist investigations in the event of an accident or incident and operational records are available for the statutory number of years after the cessation of operations for the purpose of assisting any claims of damage to health as a result of exposure to ionising radiation.

GS-R-1 3.2: In fulfilling its statutory obligations, the regulatory body: (3) … shall specify (unless elsewhere specified): (x) the emergency preparedness arrangements.

A6.39 Even though nuclear installations are designed and operated to high safety standards it is prudent to plan for accidents. LC11 ensures the licensee has adequate arrangements in place to respond effectively to any incident or accident. The arrangements must cover a wide range of events from minor incidents that are restricted to on-site locations to large incidents or emergencies that can result in a significant release of radioactive material to the environment. This Condition gives HSE the powers to ensure that the licensee's emergency arrangements are exercised. HSE uses its powers to ensure the licensee's exercises demonstrate adequate performance to protect both workers and the public.

A6.40 More detailed information on emergency arrangements' requirements can be found under Article 13.

GS-R-1 3.3: The regulatory body: (7) shall ensure that operating experience is appropriately analysed and that lessons to be learned are disseminated;

A6.41 The overall effect of several of the licence conditions is to ensure that operating experience is analysed and the results acted on. For example, LC25 ensures adequate records

are kept regarding operation, inspection and maintenance of any safety-related plant. LC28 ensures all plant that may affect safety are scheduled to receive regular and systematic examination, inspection maintenance and testing, by and under the control of suitably qualified personnel and that records of maintenance activities are kept. LC29 enables HSE, following consultation, to require the licensee to perform any tests, inspections and examinations that it may specify, and to be provided with the results. LC 30 ensures the plant is shut down in accordance with the plant maintenance schedule and these important examination and maintenance activities are carried out. This Condition also gives HSE the power to intervene and require the licensee to seek the HSE's consent to restart operations following the completion of the necessary maintenance. For nuclear reactors the licensee is required to seek a Consent from HSE to restart after every statutory shut down. Finally, if HSE has concerns about the safety of any nuclear installation and the licensee is unable or unwilling to provide the necessary safety justification for continued operation, LC 31 gives HSE the power to instruct the licensee to shut down any plant, operation or process within a given period. Following a direction to shut down the licensee will require a Consent from HSE to restart operations.

Environmental Regulation

Environment Agency

(i) Mandate and Duties

A6.42 The EA was set up by EA95 [13] to provide environmental protection and improvement in England and Wales. It is a 'non-departmental public body', sponsored largely by the Defra and the Welsh Assembly Government (WAG). It issues various permits, licences, consents and registrations, ranging from major industrial authorisations, such as a licence to abstract water from rivers, down to recreational ones such as fishing licences. The Environment Act sets out the principal aim of the EA "in discharging its functions so to protect or enhance the environment, taken as a whole, as to make the contribution towards attaining the objective of sustainable development".

(ii) Structure

A6.43 The EA has a board of 15 members, including the Chairman and Chief Executive, who are accountable to Government Ministers for the EA's organisation and performance. All are appointed by the Secretary of State for Environment, Food and Rural Affairs, except for one Board Member for Wales, who is appointed by the WAG. The Board delegates the EA's day-to-day management to its Chief Executive and staff.

A6.44 For most of its activities, the EA has broken down its work between 8 geographical regions. In each region, three committees advise the EA about the operational performance of its functions, regional issues of concerns and regional implications of national policy proposals. These committees are the Regional Fisheries, Ecology and Recreation Advisory Committee (RFERAC), Regional Flood Defence Committee (RFDC) and the Regional Environment Protection Advisory Committee (REPAC). There is also an advisory committee for Wales.

A6.45 Committee members are appointed under statutory membership schemes designed to achieve representation from a wide range of the EA's stakeholders. All REPAC meetings are advertised locally and the public is welcome to attend.

A6.46 Following a reorganisation in mid-2002, the EA has established two specialist teams (North and South) to carry out the regulation of radioactive waste disposals, including discharges of liquid and gaseous wastes on and off of nuclear licensed sites and radioactive waste management on other sites. These are supported by other national EA that cover policy, the EA's processes, monitoring and assessment of discharges, and solid waste disposal assessment.

(iii) Financial resources

A6.47 The EA has a total budget of £650 million, over half of which is spent on flood defence. Income is derived chiefly from three sources:

a) Income raised from charging for regulation;
b) Flood defence levies;
c) Government grants, which help to finance amongst other things, pollution prevention and control activities

A6.48 The EA charges operators for its nuclear regulatory activities on the basis of a daily rate for inspectors. This rate is reviewed annually. The EA also recharges operators for monitoring it carries out. Annual charges for nuclear regulatory work and monitoring activities are approximately £5 million.

(iv) Human resources

A6.49 The EA has a total of 11,000 staff, although only a small proportion of these are involved in nuclear regulation. The North and South nuclear regulatory groups have a total of 18 technical staff, with additional administrative support. The other teams described above involved with nuclear regulatory activities comprise approximately a further 20 technical staff.

(v) Inspectors' qualifications

A6.50 Nuclear regulatory staff recruited by the EA are required to have a good honours degree in science or engineering, and several years experience in a management role in the nuclear industry.

(vi) Inspectors' training

GS-R-1 .4.7: In order to ensure that the proper skills are acquired and that adequate levels of competence are achieved and maintained, the regulatory body shall ensure that its staff members participate in well defined training programmes.

A6.51 The EA has established standards of competency for its staff involved with the regulation of radioactive substances. Competence standards for nuclear regulation are separately identified within the overall framework.

A6.52 The standards are used as a benchmark for all staff, but the need to undergo a structured programme depends on the individual's experience. For more experienced staff, the standards are used informally to better target professional development. For new inspectors, attainment of the competency standards is mandatory and these are used in a formal manner.

A6.53 Developing the competences of staff is achieved by combination of structured training (for example on legal requirements) and developmental experience (for example on site inspection or issuing Enforcement Notices). The system adopted by the EA allows for competences to be demonstrated and the standards achieved to be recorded. More experienced staff act as mentors for new staff going through the competences programme.

Scottish Environment Protection Agency

(i) Mandate and Duties

A6.54 SEPA was set up by EA95 to provide environmental protection and improvement in Scotland. Powers under RSA 93 [8] are a matter for the devolved administrations in the UK, including the Scottish Executive. SEPA is a 'non-departmental public body' whose main source of funding is from Grant in Aid provided by the Scottish Executive.

A6.55 Using its statutory powers, SEPA issues various permits, licences, consents and registrations, ranging from major industrial authorisations, such as a licence to abstract water from rivers, down to recreational ones such as fishing licences.

A6.56 SEPA's main aim is to provide an efficient and integrated environmental protection system for Scotland that will both improve the environment and contribute to the Government's goal of sustainable development.

A6.57 SEPA manages a monitoring programme that assesses levels of man-made radioactivity in the environment using a number of environmental indicators. The samples of water, food, soil etc collected as part of SEPA's programme act both as indicators of the state of the environment and to verify that the levels of radioactivity present within these commodities have low radiological significance to man.

A6.58 Results from the environmental monitoring programme are used as the basis for dose calculations to members of the public from consumption of food and exposures of members of the public from waste disposals.

A6.59 In Scotland, the Food Standards Agency and SEPA liaise closely together to ensure that the environmental monitoring programme for radioactivity is appropriate. Annual results from the environmental monitoring programme are published jointly by SEPA and the Food Standards Agency in a report titled Radioactivity in Food and the Environment (RIFE)[54]. The latest results from the 2001 environmental monitoring programme have recently been published in the seventh edition of RIFE.

(ii) Structure

A6.60 Members of SEPA's Main Board are appointed by the Scottish Ministers, and comprise a Chairman, a Deputy Chairman and ten members, including the Chief Executive. The Board has ultimate responsibility for the organisation. It meets regularly and is specifically concerned with:

a) Establishing the overall strategic direction of SEPA within the policy and resources framework agreed with the responsible Minister;
b) Overseeing the delivery of planned results by monitoring performance against agreed objectives and targets;

c) Ensuring that SEPA operates sound environmental policies in relation to its own operations; and
d) Ensuring that high standards of corporate governance are observed at all times.

A6.61 SEPA also has three Regional Boards, reflecting its regional structure, each chaired by a member of the main Board. A Regional Board's general responsibilities include advising on the development of the business plans for the region, the generation and implementation of local initiatives for the environment and advising on applications that have major effects on the local area.

A6.62 Following a reorganisation in mid-2002, SEPA established a Radioactive Substances Unit to carry out the regulation of nuclear sites with a remit covering all sites located in Scotland. This dedicated Unit, covers all aspects of radioactive waste management including policy, processes, site inspections, monitoring and assessment of liquid and gaseous radioactive discharges, and solid waste disposal assessment. The Radioactive Substances Unit is also responsible for managing the UK Radioactive Incident Monitoring Network (RIMNET) in Scotland.

(iii) Financial resources

A6.63 SEPA's income is derived chiefly from three sources:

a) Income raised from charging for regulation;
b) Flood defence levies;
c) Government grant in aid, which helps to finance amongst other things, pollution prevention and control activities

A6.64 In the financial year 2001/02, SEPA's grant-in-aid from the Scottish Executive amounted to £17.3m and the total budget is £34.3m. SEPA charges operators for its nuclear regulatory activities on the basis of a daily rate for an inspector, which includes an appropriate overhead allowance. This rate is reviewed annually. Under the terms of the Environment Act 1995, SEPA is permitted to recharge operators for all monitoring it carries out.

(iv) Human resources

A6.65 SEPA has a total of some 900 staff as at the end of 2001, although the RS Unit comprises only 17 staff directly involved in nuclear site regulation.

(v) Inspectors' qualifications

A6.66 Nuclear regulatory staff recruited by the Agency are required to have a good honours degree in radiation physics or a closely related discipline, and at least 5 years experience in a management role in the nuclear industry.

(vi) Inspectors' training

GS-R-1 .4.7: In order to ensure that the proper skills are acquired and that adequate levels of competence are achieved and maintained, the regulatory body shall ensure that its staff members participate in well defined training programmes.

A6.67 SEPA has established standards of competency for its staff involved with the regulation of radioactive substances. Competence standards for nuclear regulation are separately identified within the overall framework.

A6.68 The standards are used as a benchmark for all staff, but the need to undergo a structured programme depends on the individual's experience. For more experienced staff, the standards are used informally to better target professional development. For new inspectors, attainment of the competency standards is mandatory and these are used in a formal manner.

A6.69 Developing the competences of staff is achieved by combination of structured training (for example on legal requirements) and developmental experience (for example one site inspection or issuing Enforcement Notices). The system adopted by SEPA allows for competences to be demonstrated and the standards achieved to be recorded. More experienced staff act as mentors for new staff going through the competences programme. SEPA is committed to encouraging staff to be involved with Continuing Professional Development schemes administered by the learned society or professional body they belong to. This reflects SEPA's commitment to becoming an 'Investors in People' organisation by 2004.

Annex 7 - Extracts from HSE's 'Tolerability of Risk' (TOR)

A7.1 TOR[37] gives guidelines on the tolerable levels of individual and societal risks to workers and the public from nuclear installations for both normal and accident situations. It puts forward the concept that risk can be divided into three regions on the TOR diagram {Figure A7.1 following}: an unacceptable region; the as low as reasonably practicable region (ALARP); and a broadly acceptable region.

{ In the **unacceptable risk region** arguments of reasonably practicability cease to be acceptable. In essence, risks in this region cannot be justified except in extraordinary circumstances. The maximum tolerable risk to workers should not exceed 1 in 10^3 each year. The maximum tolerable risk to any member of the public from any large industrial plant should not exceed 1 in 10^4 each year but with a benchmark figure for any new nuclear installation of 1 in 10^5 each year. For accidental risks, the risks for both normal operation and accidents taken together, then the risk for most people in the vicinity of a nuclear installation would be at or near 1 in 10^6 each year. For societal risk, the tolerable risk is linked to the number of persons affected and a figure of around 1 considerable accident per 10,000 years from any one of a programme of nuclear installations would be just tolerable bearing in mind the complications of what constitutes the programme.

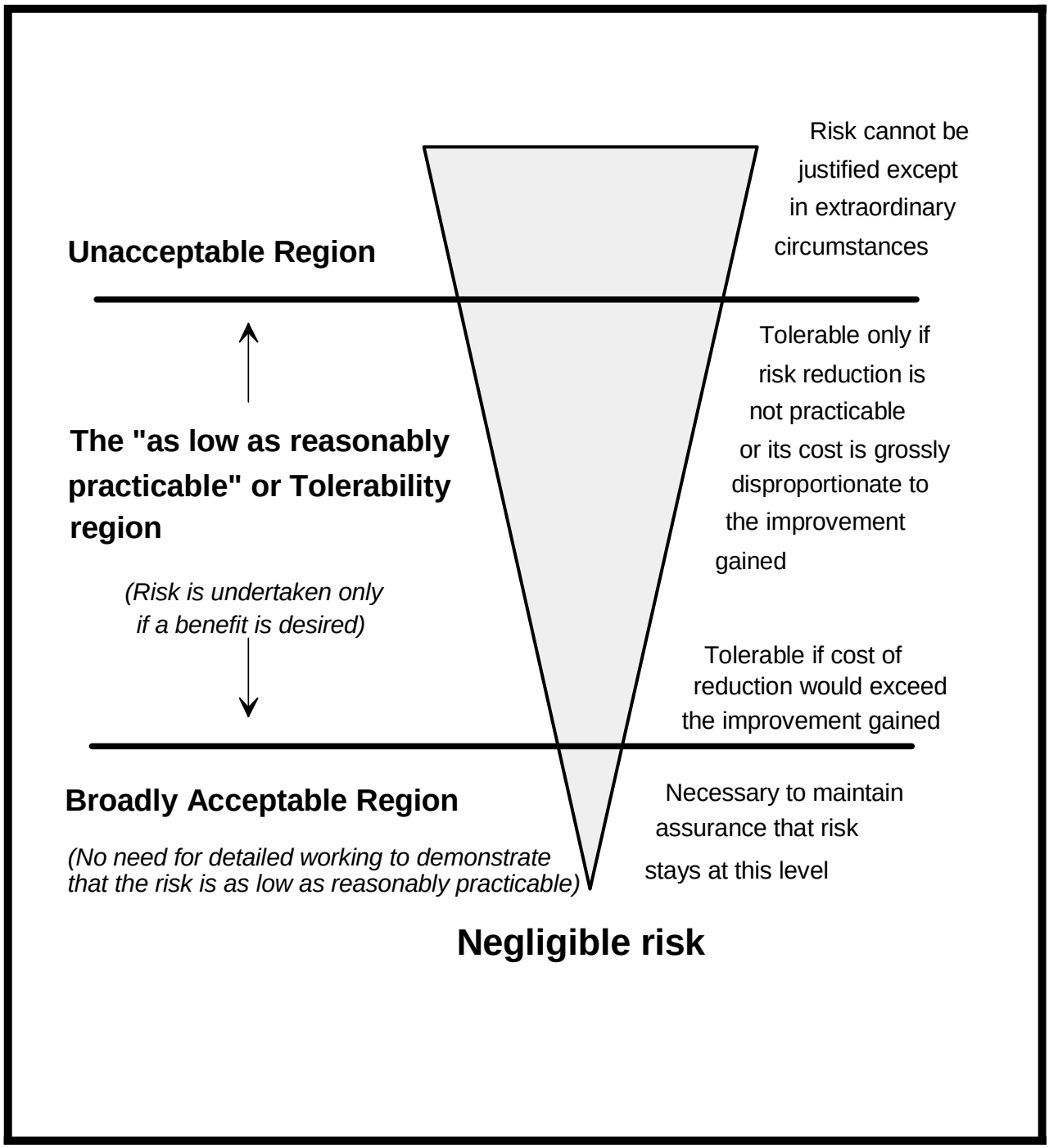
{ In the **ALARP (or tolerable) region** licensees are required to do what they reasonably can to reduce risks until the cost of doing so more than outweighs any benefit likely to be gained. The risks should be weighed against the costs of reducing them; measures must be taken to reduce or eliminate the risks unless the cost of doing so would be obviously unreasonable compared to the risks.

{ In the **broadly acceptable region**, risks are low and are so insignificant that they need not claim attention. Although the legal duty of ALARP still applies, the regulator need not ask employers and licensees (in the case of nuclear licensed sites) to seek further improvement provided that it is satisfied that the low levels of risk will be attained in practice, and maintained.

A7.2 Risks must always be balanced against the benefits arising from the activity.

A7.3 These concepts of 'unacceptable', 'tolerable' and 'broadly acceptable' levels of risk are embedded in the SAPs (see Annex 8). The SAPs are written as guidance for HSE nuclear installation inspectors to use when carrying out assessment but they are available to licensees and the public. Apart from the few that embody statutory limits, they do not place mandatory requirements on licensees. If a proposed plant design satisfies the principles, licensing is quite straightforward. On the other hand, the non-mandatory nature of the SAPs gives the UK's licensing approach a flexibility which would enable the UK, for instance, to consider licensing nuclear installations built to non-UK standards despite apparent differences in the wording of those standards and the HSE's SAPs.

Figure A7.1: Tolerability of Risk



Annex 8 - Extracts from HSE's 'Safety Assessment Principles' (SAPs)

A8.1 The safety of a nuclear installation is the responsibility of the licensee, who is required to submit to HSE a written demonstration of safety, the safety case. This safety case is periodically updated to reflect changing conditions. Assessment is the process by which HSE establishes whether the licensee's safety case is adequate. The SAPs are used for that purpose.

A8.2 SAPs define 'Fundamental' and 'Engineering' Principles, which follow the requirements of the HSW Act and the approach to risk developed in TOR (see Annex 7). The five fundamental principles are derived from recommendations of the ICRP that are implemented in the UK by the IRRs (see Article 15). They embody the requirements for statutory radiation dose limits and for the ALARP principle to be applied to radiation exposures resulting from normal operation and to the risks from accidents. The engineering principles are aimed at ensuring that, when a proposed plant comes into operation, the fundamental principles are satisfied.

Fundamental Principles

A8.3 The five fundamental principles are:

> P1 No person shall receive doses of ionising radiation in excess of statutory dose limits as a result of normal operation.
>
> P2 The exposure of any person to radiation shall be kept as low as is reasonably practicable.
>
> P3 The collective effective dose to operators and to the general public as a result of operation of the nuclear installation shall be kept as low as is reasonably practicable.
>
> P4 All reasonably practicable steps shall be taken to prevent accidents.
>
> P5 All reasonably practicable steps shall be taken to minimise the radiological consequences of any accident.

Safety Analysis

A8.4 The SAPs develop the general TOR philosophy. The concept of a limit of tolerability has been translated into Basic Safety Limits (BSLs) for the risks from normal operation and from accident conditions. A proposed plant must satisfy these limits in order to be considered for licensing. Having satisfied the BSLs, the ALARP principle is applied to drive the risks from the plant even lower. There comes a point at which further consideration would itself be more costly in HSE resources than the benefit from applying its regulatory effort to other tasks. Each BSL is complemented, therefore, by a Basic Safety Objective (BSO). The BSOs define the point beyond which HSE nuclear installation inspectors need not seek further safety improvements from the licensee. Instead, they can confine their studies to the validity of the estimates put to them by the licensee. However, the licensee

should take further risk reduction measures if it is reasonably practicable for the licensee to do so.

A8.5 The BSLs and the BSOs are related to individual and societal risks, and cover:

- { radiation doses likely to be received by workers or members of the public in the course of normal operation; and
- { the predicted frequency of accidents leading to radiation doses to workers and the public, releases of radioactive materials, or damage to plants which might lead to such releases.

A8.6 The BSLs and the BSOs therefore provide a framework against which HSE's nuclear installation inspectors can make judgements on the safety of proposals put to them.

Engineering Principles

A8.7 The Engineering Principles include criteria and guidance to assist HSE's nuclear installation inspectors determine whether engineering aspects which are important for safety have been adequately considered. They reflect best engineering practice used in engineering generally and also embody the requirements for safety, which have been developed by the civil nuclear power industry. The Engineering Principles include an emphasis on: defence in depth with multiple physical barriers to prevent the release of radioactivity; automatic safety systems; detailed fault analysis; and QA and inspection.

A8.8 The basic philosophy of the SAPs is that a new plant should be designed according to modern engineering principles. Then the design is reviewed through fault analysis and PSA to check that: the design presents low risks; it is "balanced" (i.e. no undue reliance on a particular safety feature, or undue dominance of a particular fault); and risks are ALARP. The HSE's inspectors would reject a design where the risks from its operation seem likely to exceed a BSL; but they need not challenge a case where the engineering is sound and the risks are demonstrably below all BSOs (and measures are in place to keep them so low).

Special Case Procedure

A8.9 There are components in a nuclear installation whose safety is difficult to demonstrate in such a way as to readily satisfy the accident frequency requirements of the SAPs, the reactor pressure vessel of a pressurised water reactor being an example. This possibility is catered for in the SAPs by having a principle that allows for such items to be justified on a special case basis and this route has been used on a number of occasions.

A8.10 The two particularly important safety aspects to be addressed are that: the structure is as defect free as possible; and a demonstration that the structure is defect tolerant. In order to achieve this, several related but independent arguments must be used. For example, the arguments could include a demonstration that:

- { sound design concepts and proven design features have been incorporated;
- { potential failure modes have been analysed;
- { proven materials have been used;

- there has been a high standard of manufacturing;
- a high standard of QA has been applied;
- the component has been the subject of pre-service inspection, and will be the subject of in-service inspection, to detect defects at sizes below those which have the potential for causing or developing into a failure mode;
- provision is made for in-service plant and material monitoring; and
- a leak-before -break safety case has been made.

A8.11 Where the special case procedure is applied, or where any safety system is required to achieve a high reliability, the licensee has an independent assessment of the item carried out.

Annex 9 EMERGENCY ARRANGEMENTS

GS-R-2 4.71: arrangements shall be made for promptly assessing any radioactive contamination, releases of radioactive material and doses for the purpose of deciding on or adapting the urgent protective actions to be taken following a release of radioactive material.
GS-R-2 5.25: Adequate tools, instruments, supplies, equipment, communication systems, facilities and documentation shall be provided …
GS-R-2 4.7: The transition from normal to emergency operations shall be clearly defined and shall be effectively made without jeopardizing safety.

A.9.1 The licensee, as a result of the Site Licence requirements and REPPIR, produces detailed emergency plans and handbooks for on-site response arrangements and actions including:

- declaration and cancellation conditions;
- warnings on site;
- muster and roll call arrangements;
- emergency facilities and equipment;
- emergency duties, roles and actions;
- site emergency organisation (trained teams to manage the site and plant),
- assess and repair damaged plant, search and rescue missing persons, fire fighting, and radiological monitoring of conditions on the site and plant;
- off-site radiological monitoring procedures and countermeasure strategies;
- arrangements for personal dose assessment; and
- communication systems to be used in the event of an emergency.

A.9.2 The principle objectives of the operator's response are:

- to provide radiological data and plant information to formulate counter- measure advice for the protection of the public off site;
- to ensure the safety of personnel on the site;
- to configure the plant or process in a safe condition;
- to notify supporting agencies and organisations of the occurrence of the event;
- to terminate release of radioactivity as quickly as possible; and
- to provide compensation (as specified in the Nuclear Installations Act 1965, as amended) for any damage caused in an effective and efficient manner.

A.9.3 The responses are tested and updated as necessary as a result of experiences during emergency exercises.

SS 115: V.3: The appropriate responsible authorities shall ensure that: (a) emergency plans be prepared and approved for any practice or source which could give rise to a need for emergency intervention;

A.9.4 Chapter 4 of reference 22 gives the legal position, contingency planning activities and response requirements of the following bodies for civil emergency planning:

The emergency services: the Police, Fire Services, Ambulance Service (including the

Scottish Ambulance Service);
Local authorities;
The Health Service;
Nuclear Installation Licensees;
Government Departments: DTI, Scottish Executive, Defra, Department for Transport, Department of Health and Regional Offices of the National Health Service Executive, Cabinet Office;
Regulators: HSE's NII, EA, SEPA;
The Food Standards Agency;
National Radiological Protection Board;
Meteorological Office; and
National Assembly of Wales

A.9.5 The local authority has overall responsibility for off-site emergency planning. However, in many cases exercise planning is led by the operator, who would chair the planning meetings and provide the secretariat for such meetings. The arrangements made are a matter for local agreement under the framework provided by REPPIR. Exercise planning includes provisions for meetings with representatives of organisations who contribute to the plan and wish to participate in the exercise [the planning group] and, if necessary, for meetings of specialist sub-groups to assist the development of relevant details of the exercises, for example the technical scenario and media briefing inputs. A minimum of two planning group meetings occur: one at the start of the planning process and the other towards the date of the exercise. An Exercise Director is appointed to manage the formulation, implementation and execution of the arrangements and to provide a focus for consultation with other interested parties. The secretariat for the planning meetings record and report the issues discussed.

SS 115: V.3: The appropriate responsible authorities shall ensure that: (b) Intervening Organizations be involved in the preparation of emergency plans, as appropriate;
GS-R-2 3.12: All organizations that may be involved in the response to a nuclear or radiological emergency shall ensure that appropriate management arrangements are adopted to meet the timescales for response throughout the emergency. Where appropriate, the management system shall be consistent with that used by other response organizations in order to ensure a timely, effective and co-ordinated response.

A.9.6 The Nuclear Emergency Planning Liaison Group (NEPLG) is a forum that brings together, under DTI chairmanship, the organisations with interests in off-site planning for an emergency at a civil nuclear licensed site. The Group identifies, discusses and finds solutions to common problems, and agrees improvements in planning, procedure and organisation that form a framework of advice to emergency planners.

A.9.7 NEPLG was established in 1990 and meets twice a year and formulated guidance on a wide range of emergency planning issues, taking into account national and international best practice. Most of the detailed work in preparing this guidance has been taken forward in Sub-Groups that meet on a more frequent basis to prepare and review proposed guidance that is endorsed by the main group prior to issue. Some of these Sub-Groups have limited tasks and have a limited lifespan for the duration of consideration of the particular topic. However, there are also two permanent Sub-Groups, each of which generally meets twice a year. The Process Review Sub-Group, which DTI chairs, looks forward to new developments in civil

nuclear emergency planning, and advises NEPLG on priorities and future work. It also considers, and makes recommendations for amendments to the Consolidated Guidance. The Lessons Learned Sub-Group, which NII chairs, proposes a draft report to NEPLG summarising the lessons of the exercises held during the previous planning year. It also oversees the progress and action tracking of lessons from exercises.

A.9.8 NEPLG guidance is disseminated in a series of "principles" documents and reports. A Handbook consolidates the guidance into one document for general reference by planners and practitioners concerned with emergency response at civil nuclear sites. As the Handbook is based on the general principles that apply to all emergency planning, it may also be applicable to emergency planning beyond the nuclear industry as a good practice guide.

SS 115: V.3: The appropriate responsible authorities shall ensure that: (c) the content, features and extent of emergency plans take into account the results of any accident analysis and any lessons learned from operating experience and from accidents that have occurred with [reactors] of a similar type; (d) emergency plans be periodically reviewed and updated;
GS-R-2 3.16: Operators, the national co-ordinating authority and other appropriate organizations shall periodically conduct a review in order to ensure that all practices or situations that could necessitate an emergency intervention are identified, and shall ensure that an assessment of the threat is conducted for such practices or situations.

A.9.9 The Lessons Learned Sub-Group of NEPLG reviews all actions for level 2 and 3 exercises and produces a report on behalf of NEPLG to identify the key areas for development in forthcoming exercises. The report summarises the lessons of level 2 & 3 exercises held during the previous emergency exercise planning year. This is a statement of the overall view of exercises together a summary of matters and issues that need to be either considered or resolved. The sub-group submits the draft report to the June meeting of NEPLG for endorsement, comment and further dissemination. The Sub-Group also prepares a progress report on the actions taken to resolve the issues identified in the report that is submitted to the winter meeting of NEPLG for endorsement, comment and further dissemination.

GS-R-2 5.33: Exercise programmes shall include the participation in some exercises of as many as possible of the organizations concerned.

A.9.10 Level 2 exercises are aimed primarily at demonstrating the adequacy of the arrangements that have been made by the local authority to deal with the off-site aspects of the emergency, particularly the functioning of the Off-Site Facility [OSF] where organisations with responsibilities or duties at the OSF are encouraged to exercise their functions.

A.9.11 From the annual programme of level 2 exercises one is chosen as a level 3 to rehearse the functioning of the OSF and also the wider involvement of central government, including the exercising of the various government departments and agencies attending the Nuclear Emergency Briefing Room [England and Wales] in London or the Scottish Executive Emergency Room in Edinburgh. The decision on which exercise should be selected as the level 3 is made jointly between the licensees, the lead government departments [DTI or Scottish Executive] and NEPLG in consultation with HSE. The primary aim is to ensure that

each licensed site exercises its OSF every three years. An annual programme of these exercises is compiled and published by HSE in consultation with licensees. The programme is necessarily based on proposals from the latter, which takes into account the following important considerations:

(a) the dates of previous exercises;
(b) the availability of the OSF; and
(c) the availability of organisations that contribute to testing the approved plan.

A.9.12 HSE co-ordinates the national exercise programme to ensure there is an acceptable periodicity between demonstrations. Licensees may therefore be asked by HSE to reconsider their proposal and, if so, must consult further with the appropriate local authorities and agencies before putting forward any revised dates. The proposed three-year programmes are submitted, by the operators, to the Nuclear Emergency Arrangements Forum (NEAF) Secretariat. NEAF is a forum where HSE and the operators meet to discuss planning, operations and regulatory issues on emergency arrangements. The overall programme is published by HSE every six months as 'The UK National Emergency Exercise Programme for Licensed Nuclear Sites' and gives firm dates for the forthcoming planning year, best estimate times for the following year and a list of participating OSFs for the year after. The programme for the first year also includes level 1 exercises.

SS 115: V.4: Emergency plans shall include, as appropriate:
(b) identification of the various operating and other conditions of the [nuclear installation] which could lead to the need for intervention;

A.9.13 The safety case for the nuclear installation identifies such conditions, and is addressed in more detail under Article 18. Also, a range of tools, including computerised support systems, are used by different operators to predict the future consequences of plant situations: these range in focus from core conditions and future evolution through to off-site dispersion and deposition and consequent public exposure from radionuclides released to the environment. Other bodies, such as national authorities employ tools appropriate to their responsibilities.

SS 115: V.4: Emergency plans shall include, as appropriate: (c) intervention levels for the relevant protective actions and the scope of their application, with account taken of the possible degrees of severity of accidents or emergencies that could occur;
SS 115: V.12: Intervention levels for immediate protective actions shall be specified in emergency plans
SS 115: V.19: Intervention levels for temporary relocation and return of exposed persons shall be specified in emergency plans
GS-R-2 4.20: The emergency classification system for facilities … shall .. predefine emergency action levels (EALs) that relate to abnormal conditions for the facility

A.9.14 In the UK the NRPB is the independent body with the responsibility for specifying and giving advice on emergency reference levels (ERLs) [50] for the public. The NRPB also give other guidance for return and relocation. The ERLs are levels of 'dose saved' at which it is justifiable to introduce countermeasures. In recommending any ERL, the NRPB balances the risk from potential radiation exposures against the risks that may be associated with the counter measure.

A.9.15 The ERLs are formulated in a two-tier system of dose levels of dose saved for the public. The lower levels of dose saved have been recommended as being levels below which countermeasures should not, in general, be taken because the conventional risks and social disruption resulting from the countermeasures are likely to outweigh the benefits. The upper levels of dose saved have been recommended as being those at which action should almost certainly be taken. At values between these upper and lower bounds of ERL the implementation of countermeasures is desirable but not essential and must be considered in the light of the situation at the time. The application of the ERL is aimed at ensuring that risks to the health of individuals are minimised. If the response is based on the ERLs, any resulting health effects would be small and would not subsequently be distinguished from the normal incidence of such effects. The ERLs are subject to a continuing review to reflect developments in the understanding of radiation risks.

A.9.16 In drawing up and developing emergency plans the ERLs together with the predictions of the course of the accident and the likely effectiveness of the countermeasures are used to define site-specific intervention levels of dose saved. The intervention levels of dose saved expressed in directly measurable quantities are used to provide advice on possible protective actions. The advice is given to the Police who carry the final responsibility for instigating the necessary measures taking account of the local situation at the time.

A.9.17 The recommendations and advice provided by the NRPB cover the following countermeasures and actions:

- **Sheltering** - the public would be advised to stay indoors, close doors and windows and follow advice given by local radio and television stations or other agreed notifying arrangements. Sheltering reduces the risk of exposure to direct radiation and the inhalation of radioactive material.
- **Taking of stable iodine tablets** - potential consequences from postulated accidents at spent fuel, reprocessing and radioactive waste management facilities are often dominated by the effects of radioactive iodine because of its relatively high volatility. The taking of stable iodine tablets can significantly reduce the iodine uptake by the body and thus reduce the likely radiation dose.
- **Evacuation** - this is an important counter measure as it removes the person from further exposure. It is however socially disruptive and incurs other risks.
- **Control of contaminated or potentially contaminated food supplies** (defined in the European Council Regulation on maximum permitted radionuclide concentrations in foods)[103] - statutory authority for food safety rests with the Food Standards Agency, which will give advice and recommendations to protect the food chain. NRPB advice is also available on this subject.
- **Control of contaminated or potentially contaminated water supplies** – The responsibility for ensuring a wholesome supply of water rests with the relevant water company (for public supplies) or local authority (for private supplies). In England and Wales, Defra discharges its regulatory responsibility through its Drinking Water Inspectorate and obtains relevant advice from the EA. In Scotland, that is done respectively by the Drinking Water Quality Unit of the Scottish Executive Environment and Rural Affairs Department (SEERAD) and by SEPA, which also assists with monitoring of contaminated waters and advises on appropriate restrictive measures to take.

SS 115: V.4: Emergency plans shall include, as appropriate: (a) allocation of responsibilities for notifying the relevant authorities and for initiating intervention
SS 115: V.6: On-site emergency plans shall be implemented by licensees.
GS-R-2 4.12: When circumstances necessitate an emergency response, operators shall promptly determine the appropriate emergency class or the level of emergency response and shall initiate the appropriate on-site actions. The operator shall notify and provide updated information, as appropriate, to the off-site notification point.

A.9.18 The site operator's emergency plan covers the operator's emergency planning arrangements both on and off the site and the procedures for their initiation. The plan is supported by detailed instructions on the actions to be carried out by the operating staff. Local and central Government have copies of the site plans. There are also copies available in the public libraries local to the Site.

A.9.19 For all nuclear installations in the UK there are a number of common elements in their emergency plans. These are:

- The plan would be invoked by a senior manager of the plant, present on the site at the time of the emergency.
- The nature and likely development of the event, together with possible consequences for the safety of people on and off the site, determine the level of warning that would be declared. The plans specify the level of warning to be declared for a range of conditions. This generally covers the following two situations:
    - a hazardous condition which is confined in its effect within the site security fence (a hazard to site personnel only);
    - a hazardous condition which results, or is likely to result, in the need to consider urgent counter measures to protect the public outside the site security fence from a radiological hazard.
- The senior manager invoking the emergency plan is nominated as the Site Emergency Controller. Only designated site staff can act in this capacity and they are identified in the plan and associated handbooks. Only the Site Emergency Controller can declare, upgrade or cancel the emergency state declared above.
- The Site Emergency Controller would be located in the emergency control centre on the site (supported by a team of engineers, scientists and administrative staff) and be responsible for directing the Operator's emergency response organisation. This would include, in the initial stages of an emergency, notifying relevant off-site organisations and recommending actions for the protection of site personnel and members of the public, as appropriate.

A.9.20 The control of the nuclear installation involved in an accident begins and remains with the operator who is responsible throughout for bringing the plant under control and thus reducing any off site consequences. At the outset the operator is responsible for notifying the appropriate authorities. In the initial stages it is only the operator who can assess the position and give guidance on any counter measure required to protect the public. The operator also maintains a system that can monitor any release of radioactive material from the plant.

A.9.21 In addition to emergency control centres on the sites, all off-site emergency plans make use of additional facilities available at some distance from the Site. These off-site

emergency facilities are part of the emergency arrangements for dealing with emergencies that have or might have off-site radiological consequences. The facilities are sited at a sufficient distance from the site to make it highly unlikely that they would be subject to any direct threat from a radiological release during the emergency, but have local knowledge and expertise.

GS-R-2 5.10: Arrangements for the co-ordination of emergency response and protocols for operational interfaces between operators and local, regional and national governments shall be developed, as applicable.

A.9.22 The declaration of a nuclear emergency will initiate procedures for setting up the off-site facility (OSF) that will become operational a short time after the declaration of the emergency. Once the facility is operational it takes on the responsibilities for communicating and coordinating with the off-site agencies thus leaving the Site Emergency Controller and site staff to concentrate on the control of the accident on the Site. The site emergency controller and his staff do not isolate themselves from the off-site agencies once the OSF is operational, since contact is maintained with the operator's technical support team at the OSF. The operator's technical support team ensures that information on the developing situation at site is distributed to all organisations at the OSF including the GTA. In addition, HSE despatches a team of inspectors to the incident site and upon their arrival they establish contact with the HSE team at the OSF and keep them informed of the situation on the site. The HSE OSF team keeps the GTA informed of the developing situation as do other agencies including MAFF and NRPB.

SS 115: V. 13: Action levels for the withdrawal and substitution of specific supplies of food and drinking water shall be specified in emergency plans as appropriate.
SS 115: V.17: Agricultural, hydrological and other technical or industrial protective actions shall be considered following contamination of land or water after an accident
SS115, 3.14: Optimized intervention levels and action levels shall be specified in plans for intervention situations

A.9.23 In accordance with the Food Standards Act 1999, the Food Standards Agency's statutory objective is 'to protect public health from risks which may arise in connection with the consumption of food'. The Agency's role in a nuclear emergency will be to ensure that the public is protected from contaminated food. Specific responsibilities are as follows:

- To determine the level of any contamination of the food chain.
- To take action to ensure that food contaminated to unacceptable levels does not enter the food chain, implementing, as necessary, restriction orders under the Food and Environment Protection Act 1985.
- To provide advice and information to the public.
- To ensure, in conjunction with the Environment Agencies, the safe disposal of contaminated food.
- To ensure that subsequent recovery arrangements take account of food safety issues.

A.9.24 In any future accident where radioactivity is released into the environment, the criteria for intervention in food safety (at least in the early phase of the emergency) will be the Council Food Intervention Levels (CFILs) laid down by the European Union.

A.9.25 The FSA will aim to issue precautionary food safety advice to the public as soon a possible, probably within a few hours, following the declaration of a nuclear emergency. On notification, FSA will carry out a rapid assessment of the emergency's potential impact on food safety, using whatever information is available. In the early stages of an accident this may consist of an estimate of source term from the site operators, or a few measurements of air-borne radioactivity close to the site. If it is assessed that levels of radioactivity in any potential food products may exceed the CFILs as a result of the accident, the Agency will describe the area in which the relevant CFILs might be exceeded, name the food products affected and advise on the actions to be avoided (e.g. eating, collecting, harvesting or transporting). The products may include agricultural produce, domestic garden produce, fish, shellfish and any other food materials exposed to the accidental release (in markets stalls for example). Due to the processes of radionuclide transfer in the environment, some food materials in the affected area (such as milk and meat) may not reach their peak radioactivity concentrations until a few days after the accidental release. The FSA will aim to allow for this effect, so that its initial advice covers any area where the intervention levels would later be exceeded. Advice, as appropriate, will be issued to food producers so they can minimise contamination of their products.

A.9.26 In defining the area over which its precautionary advice should apply, the FSA will generally use cautious assumptions. This is on the basis that it is better, in terms of maintaining public confidence, to over-estimate the area and subsequently reduce it than to under-estimate it and necessitate a subsequent enlargement. The area will also have to be easily described in the format of a radio or TV announcement, and may be defined by postcodes, district/county boundaries or geographical features.

A.9.27 Where appropriate, the FSA will support its precautionary food safety advice with a statutory restriction order, made under the Food and Environment Protection Act (FEPA) 1985. A FEPA order delineates an area, using legally enforceable boundaries, and prohibits certain activities related to food gathering or production within that area. To construct and produce such an order is expected to take at least 24 hours from the declaration of an emergency. Given that monitoring information further to that used in the initial assessment will be available by this time, and uncertainty reduced as a result, it is to be expected that the area covered by a FEPA order may be smaller than that affected by precautionary food safety advice.

A.9.28 Due to its statutory role, the FSA holds principle responsibility for decisions on food safety advice and restriction orders following a nuclear emergency. The FSA, however, will always inform other organisations of its intended actions and will consult them for their views whenever possible. Such liaison is necessary for a variety of reasons but, primarily, so that information reaches the public in a coordinated and consistent way. Liaison between FSA staff and those from other organisations involved in the emergency response will occur in a number of ways:

- Between FSA and other staff at the off-site facility;
- Between FSA HQ and the HQ of other organisations;
- Between FSA HQ and the off-site facility, prior to the arrival of the FSA team at the off-site facility; and
- Between FSA and other staff at the NEBR.

A.9.29 Ideally, consultation on food safety measures will take place between the FSA representative at the off-site facility and relevant co-located staff, such as the GTA and Gold Commander. Indeed, the primary responsibility of the FSA representative at the off-site facility will be to advise and consult other organisations on the FSA response. This may not always be possible in the early stages of an emergency, however, if FSA staff are traveling from London to a remote off-site facility. Other means of communication will then need to be employed.

A.9.30 Effective liaison between the FSA and others is particularly important because of the inherent difference between food safety advice and other countermeasures. The area covered by food safety advice in any foreseeable emergency will greatly exceed the area covered by any other countermeasure. The phenomenon is regularly demonstrated in exercises where evacuation or sheltering are simulated to just a few km from the site, while food advice may reach out to over 100 km. Such apparent inconsistency needs to be treated with care. Otherwise, the public may assume that the various organisations responsible for their safety differ in their access to information, their willingness to share it or their competence. Such assumptions would seriously undermine public confidence.

A.9.31 The introduction of countermeasures such as evacuation or sheltering, if required, will usually precede food safety advice. Announcement of these countermeasures may currently be made with the clear inference that people outside the sheltering/evacuation area will not be subject to any effect of the emergency. It is these people who, when in receipt of food safety advice shortly afterwards, may feel that they are being misinformed or misled. It is therefore suggested that advice on non-food countermeasures is accompanied with a statement that food safety advice regarding crops and livestock may cover a wider area. This addition could be pre-planned, automatic, and need not rely on advice from FSA at the time.

GS-R-1, 6.6: "In planning for, and in the event of [a nuclear or radiological emergency], the regulatory body shall act as an adviser to the government and [response organizations] in respect of nuclear safety and radiation protection."

A.9.32 On the notification of an off-site emergency at a nuclear power station the DTI (for stations in England and Wales) or the SE (for stations in Scotland) will arrange for the appointment of a Government Technical Adviser (GTA), following advice from the HSE's Chief Inspector of Nuclear Installations. The GTA would normally be one of HSE's Deputy Chief Inspectors of Nuclear Installations and would be responsible during the course of the emergency to the lead Minister. The GTA would represent the primary source of technical advice and information to all the relevant off-site agencies. In preparing this advice, the GTA would have the benefit of up-to-date information and close contact with the local agencies and operator of the spent fuel, reprocessing and radioactive waste management facility.

A.9.33 The appointed GTA will be sent to the local off-site facility and would assume the following responsibilities:

a) to provide independent and authoritative advice to the Police and other Authorities handling the off-site response to the emergency on all matters relating to:
   i) the appropriate counter measures off-site to protect the public and the personnel of the various agencies involved;

ii) the cause of the emergency on-site and its effects on the environment beyond the site; and
iii) the end of the on-site emergency and the return to normality off-site.

b) at media briefings to provide, where necessary, an authoritative response on behalf of the Government on all these matters; and
c) to ensure that the lead Government Department is kept fully informed on all matters relating to the emergency.

A.9.34 The GTA would meet all the other authorities represented at the off-site facility and would ensure that an adequate assessment on the way the situation was developing, and likely to develop, was available as required for the facility's representatives to make decisions and take appropriate actions. The GTA position is advisory and does not carry any executive responsibility. Once the GTA is appointed, the state of emergency can only be terminated on the advice of the GTA, in consultation with the operator, the various organisations dealing with the emergency and central Government organisations.

A.9.35 To assist communications between the GTA at the off-site facility and the NEBR or SEER, the lead Government Department nominates a Senior Government Liaison Representative (SGLR) to support the GTA at the off-site facility. The SGLR would be a Senior Government Officer and would provide a direct link to the NEBR or SEER and, if necessary, Government Ministers. The SGLR would ensure that the GTA was informed of Central Government actions and would also keep the NEBR or SEER informed of actions taken at and media statements issued from the local off-site facility. This is to ensure that co-ordinated, consistent and unambiguous advice is given to the general public through the media.

GS-R-2 4.27: Arrangements shall be made for response organizations to have sufficient personnel available to perform their assigned initial response actions.

A.9.36 One of the principal objectives in formulating arrangements into an emergency plan is to provide effective action at all stages of a nuclear emergency. This includes having sufficient emergency responders when they are needed. Exercising the emergency plan at levels 1, 2 and 3 provides confidence that there will be sufficient personnel available.

GS-R-2 4.28: Arrangements shall be made to provide a response to a nuclear or radiological emergency for which detailed plans could not be formulated in advance.

A.9.37 General contingency plans are maintained by a wide range of organisations to deal with various civil emergencies from industrial accidents to natural disasters such as flooding. In considering whether, and to what extent, these need to be enhanced to deal with a larger emergency at a civil nuclear site, a balance should be struck between ensuring that plans are sufficiently extensive to cope with serious emergencies, and avoiding a waste of resources that could occur through over-planning for most improbable emergencies. The extended response should be based on the planning arrangements made for the detailed emergency planning zone (depz).

A.9.38 It is a long standing guiding principle of civil nuclear emergency planning that detailed plans covering the area defined by the depz should be drawn up on the basis of the reasonably foreseeable accident (i.e. the design basis accident or reference accident), which is now required through REPPIR[18]. These plans must be capable of being extended using

general contingency plans to deal with a larger, even less likely accident. The improbability of a larger accident means that the absence of a detailed plan would not significantly increase the risk to the public.

A.9.39 This guiding principle was looked at by the Inspectors for the Sizewell B and Hinkley Point C Public Enquiries. Both Inspectors considered the potential impact on the community of a larger than design basis accident. The Sizewell Inspector considered a range of Scenarios from design basis up to a major conflagration affecting Sizewell B. He also arranged for a tabletop exercise based on an extremely demanding extended scenario to take place before approval for construction was given. The Hinkley Inspector drew comparisons with other major events and concluded that planning in detail to meet every conceivable emergency was impractical. He could not see why any different principle should apply to nuclear plants. Both Inspectors endorsed the "extendibility" principle. The Hinkley Inspector also took account of the impact of the Chernobyl accident on emergency planning in his deliberations. As a result, general contingency plans are examined to ensure that the aspects listed below are properly addressed. These aspects also form part of the wider requirement of planning within the detailed emergency planning zone. Plans:

(a) define the responsibilities and functions of the organisations that would respond to an emergency. They also include a description of the powers, resources and facilities of those organisations, and indicate how and where each organisation would be mobilised, and how the total response including the advice on countermeasures would be coordinated;
(b) define arrangements for the provision or receipt of aid from neighbouring emergency services and local authorities. Due account should be taken of the implications of cross county, regional or legislative boundaries;
(c) state the arrangements for communication between all those organisations that could be called upon to become involved in the response. Consideration is given to the possibility of using diverse means of communication. Consideration is also given to preparing a register of all communications facilities and equipment that would be available for use in the response;
(d) describe the means of warning the public. The efficient and timely implementation of countermeasures is particularly dependent on the adequacy of these arrangements;
(e) contain basic information on the arrangements for handling the media.
(f) take account of the requirements for providing the public with information in the event of a radiological emergency;
(g) contain basic information on resources generally available that should be helpful in effecting countermeasures. This should include information on population sizes, transport availability, pickup points, routes, availability of personnel and sources of specialised equipment;
(h) identify buildings suitable for use as Reception Centres for evacuees. In each case, information on the capacity and suitability of the centre is maintained together with information on the arrangements for opening, setting-up and staffing the centre, including 24 hour contact details for all relevant personnel;
(i) include information on locations that have special features that could be important in any response and develop strategies for overcoming the problem. Such features include the presence of significant numbers of people (e.g. hospitals, schools and old peoples' homes); major communications routes and facilities (e.g. motorways, ports and airports); and factories and other industrial installations that might have special

problems in any implementation of countermeasures (e.g. places where there are hazardous processes which could not be readily abandoned);

(j) identify roads or routes where traffic congestion might present a problem in the event of an extended response, and consider plans to ease this congestion; and

(k) include information on the resources and arrangements for radiological monitoring, both personal and environmental.

A.9.40 Sheltering, evacuation and issue of potassium iodate tablets and restrictions on contaminated foodstuffs are all countermeasures that should be considered in examining contingency arrangements. In determining which would be most appropriate to particular circumstances, the local emergency services and relevant Government Departments should take account of all relevant circumstances including the characteristics of the potential release, the weather conditions, the local demography and geography, and the practicalities of implementation.

A.9.41 In applying one or more of the relevant countermeasures beyond the detailed emergency planning zone, efforts should first be directed at those most at risk.

A.9.42 It is acknowledged that a number of people may try to evacuate in advance of official advice. However, this would be discouraged as this could lead to severe road congestion and accidents. Contingency arrangements covering evacuation should be sufficiently flexible to enable only affected sectors to be evacuated, but allow for practical factors to be taken into account such as, the uncertainty of the weather conditions, or where whole villages or towns overlap sectors, or the availability of traffic routes.

A.9.43 Contingency arrangements should cater for the need to identify visitors to the area and people out of doors, and the need to warn them, if necessary, of what action to take, i.e. to shelter. Places where people may be visiting such as attractions, hotels, etc should be identified in the plans and this will assist in locating visitors.

A.9.44 Where the distribution of potassium iodate might be appropriate, contingency arrangements should identify locations where potassium iodate tablets are stored and how they might be distributed.

A.9.45 The elements that might need to be tested in an extended scenario are not different to those for scenario based on the reasonably foreseeable accident in most respects. However, there are additional elements, which need to be considered as part of the planning process for any extendibility exercise, and decisions need to be taken by the planners on what elements or aspects should be tested and how this should be done. In these circumstances, it is recommended by NEPLG that at the start of the planning process for any extendibility exercise, the key elements for testing are identified taking account of the requirements of planning, and that these help determine the scenario for the exercise.

A.9.46 An emergency exercise aimed at testing extendibility follows the usual principles of good exercise planning, especially in respect of properly addressing the objectives of the participating organisations. It involves a major demand on resources by all the many organisations that would be involved in the response. They are necessary to test arrangements and identify lessons for participating organisations. However, in the light of these circumstances and the improbability of such an event happening, such exercises are not held too frequently. One was held at Heysham in 1997 and one at Bradwell in 2002. Decisions on

future extendibility exercises will be taken by DTI as lead department in consultation with the national and local organisations concerned.

GS-R-2 4.39: arrangements shall be made for mitigatory actions by the operator to prevent an escalation of the threat, to return the facility to a safe and stable state, to reduce the potential for releases of radioactive material or exposures and to mitigate the consequences of any actual releases or exposures.
GS-R-2 4.48: arrangements shall be made for effectively making and implementing decisions on urgent protective actions to be taken off the site.
GS-R-2 4.56: arrangements shall be made to protect emergency workers.

A.9.47 LC 11 requires emergency arrangements to be made. Some of the principal objectives in formulating arrangements into an emergency plan are to:

(a) bring the nuclear emergency under control and bring the site to a safe condition;
(b) ensure that those who are involved in dealing with the nuclear emergency at the site are not put to unnecessary risk and, in particular, to ensure that they are not exposed to unnecessary radiation doses;
(c) introduce countermeasures where and as appropriate to minimise the risk to those outside the site, in particular members of the public; and
(d) ensure that the arrangements reflect the possibility of an extended response being necessary.

GS-R-2 4.67: Radiation monitoring and environmental sampling and assessment shall be carried out in order to identify new hazards promptly and to refine the strategy for response.

A.9.48 Site emergency plans include provisions for monitoring radioactivity. Monitoring equipment installed on the site will provide information on the amount of radioactive material being released to the environment. The operator would also dispatch specially equipped mobile monitoring teams to measure the radioactivity in the plume as it traveled downwind from the site and also the level of radioactive material deposited on the ground. The area local to the site covered by the operator's mobile monitoring teams will depend on the type of installation and will vary between 15 and 40 km. The NRPB would co-ordinate monitoring for radioactivity. Operators have arrangements for other sites operated by them to provide additional monitoring teams and national mutual aid agreements between the UK operators also provide for monitoring assistance if this is requested.

A.9.49 Additional monitoring for radioactivity by Defra and the EA (or the SEERAD and SEPA in Scotland and the National Assembly for Wales), local authorities, water undertakers, and Ministry of Defence would provide further information so that longer-term decisions regarding restrictions on milk, foodstuffs and water supplies could be made. Potential public exposure to radiation from contaminated foodstuffs and milk would not present as immediate a hazard and thus there would be time for appropriate restrictions to be introduced in affected areas. Rather, the Food Standards Agency would issue precautionary advice within a few hours followed up by food restrictions if deemed necessary once monitoring results were available.

A.9.50 Monitoring information would also be available from the Defra's RIMNET system

that continuously monitors gamma radiation dose rates at 92 stations throughout the UK. In addition, the system allows approved organisations throughout the UK to enter a wide range of other radiological measurements - of air, food, water, and the environment - which would be used to assist the response. This system is intended to detect the presence of radioactivity from any source whether from an overseas accident or an accident in the UK. It would play an important role in establishing those areas that were not affected by the accident. Wider-scale monitoring information would also be available from those local authorities that have established their own independent radiation monitoring capabilities.

GS-R-2 4.68: Information about emergency conditions, emergency assessments and the protective actions recommended and taken shall be promptly made available to all relevant response organizations throughout the period of the emergency.

A.9.51 Monitoring information and other information on the emergency is relayed back to the relevant off-site facility and provides the means whereby:

(a) relevant local and national agencies receive full and authoritative information about the accident;
(b) advice is provided to those charged with local executive actions to protect the public; and
(c) information about the accident is formulated for the media and the public, and
(d) coordinated action is taken to protect the public.

A.9.52 Representatives of agencies, services and organisations attending the off-site facility have clear responsibilities for defined functions regarding the formulation of advice, the implementation and co-ordination of protective action and the provision of information. Responsibility for establishing and managing both the offsite facility and the press briefing facility is defined. The arrangements for operating the off-site facility clearly state who is responsible for supplying information to relevant outside bodies and organisations.

GS-R-2 4.73: Arrangements shall be made to ensure that relevant information is recorded during an emergency and retained for use during the emergency, in evaluations conducted following the emergency and for the long term health monitoring and follow-up of the emergency workers and members of the public who may potentially be affected.

A.9.53 Records are required to be kept of actions taken during an emergency on the licensed site and in the vicinity of the site. In additions, discussions, agreements and actions at the off-site emergency and other emergency response centres will be recorded. During an accident the HSE response is primarily one of witnessing monitoring and recording the operators response to the event. The responsibility for taking corrective actions at the site remains with the operator. The use of enforcement powers during an event would only be used in an extreme situation following consultation with senior HSE staff and the GTA.

GS-R-2 4.80: Arrangements shall be made at the national level to treat people who have been exposed or contaminated.

A.9.54 Primary Care Trusts (PCTs), National Health Service (NHS) Boards and NHS Trusts in Scotland have responsibility for promoting the health of the population in their area

and securing the provision of health services to that population.

A.9.55 All PCTs need to have suitable plans in place to respond to a nuclear incident, including an accident at a civil nuclear site within their boundary or the spread of nuclear contaminants across their border. Their plans cover arrangements for the provision for health care; advice to health professionals and the public; radiation monitoring for people exposed or possibly exposed to radiation.

A.9.56 PCTs with civil nuclear sites within their boundaries are closely involved with the site operator's emergency planning and response arrangements. However all PCTs are required to designate hospitals prepared to receive radiation casualties and ensure that appropriate facilities are available in hospitals for both contaminated casualties and for persons suffering from significant radiation injury. PCTs with civil nuclear sites within their boundaries take the lead in planning for the distribution of stable iodine tablets in consultation with the operator, local authority and emergency services. Tablets may be distributed by various agencies, for example the police or site operator.

A.9.57 Within designated Police Authority areas PCT emergency plans will establish appropriate arrangements for the co-ordination of the health response to an incident involving radioactivity. These coordinating arrangements will include:

- who takes the lead in acquiring an overview of the impact and resulting health needs of this type of incident, and
- the designated lead to establish and chair a Health Advisory Group (or other appropriate grouping), which will provide health advice to the incident team.

A.9.58 The designated lead to acquire an overview will:

- co-ordinate the knowledge available as to the health hazards presented by the incident;
- assess the consequent risks to public health;
- advise on strategies designed to minimise these hazards; and
- following consultation with the GTA or Site Emergency Controller that the relevant parameters have been met, authorise the implementation of plans for the issue of potassium iodate.

A.9.59 The Health Advisory Group/Cell will:

- provide the generic advisory function for the protection of health that forms part of the Gold Command (Strategic Command in Scotland) protocols in Police Force areas;
- establish the information base needed to evaluate the long-term epidemiological consequences of the incident;
- instigate any investigations found to be necessary ;
- remain responsible throughout the incident for providing health services within their geographical area; and
- in the recovery phase, take responsibility for coordinating more detailed assessments of any immediate health impacts.

A.9.60 Strategic Health Authorities or the NHS Boards in Scotland will in association with Regional Directors of Public Health (RDsPH) and Regional Health Emergency Planning

Advisers (HEPAs), Chief Executives of Strategic Health Authorities ensure that:

- Trusts within their areas have appropriate emergency and response arrangements, which are regularly tested;
- appropriate arrangements are in place to co-ordinate the health contribution to the overall response to a widespread incident or one that significantly threatens NHS capacity and that these arrangements are set out in explicit local arrangements;
- satisfactory arrangements are in place for representation at Police Strategic 'Gold Controls'; and
- appropriate arrangements are in place with Chief Executives of adjacent Strategic Health Authorities where Police Authorities are not co-terminus.

A.9.61 There are clear arrangements with all PCTs for upward reporting of major incidents, including out-of-hours and media handling.

A.9.62 NHS Hospitals designated for the reception and treatment of irradiated an/or contaminated casualties ensure that:

- detailed emergency plans are drawn up and regularly exercised;
- there are clear procedures for activating the plan;
- appropriate staff are designated and given specific training;
- space is allocated where reception and treatment can take place without risk of further contamination of areas and people (The facilities are the same as those required for chemical contamination);
- space is allocated for vehicles that may be contaminated;
- special equipment and materials are provided and properly maintained;
- specialist advice and assistance is readily available from a designated local medical physics department; and
- someone in authority is appointed to deal with enquiries and with representatives of the press and other media.

A.9.63 When accident cases are received, the hospital trust will be responsible for ensuring that the emergency plan is put into effect, and that employers and relatives of the accident victims are informed.

A.9.64 The Ambulance Service role in a nuclear incident forms part of the NHS's statutory responsibility for the care of sick or injured persons in the UK. The key roles and responsibilities of the Ambulance Service in a major incident are to:

- Co-ordinate the on-site operational NHS response. The necessary procedures would be initiated from the Ambulance Control Centre as soon as a major incident is suspected, or confirmed.
- Assess the incident. The first officer or crew to arrive at the scene would assess the incident and report to the Ambulance Control Centre. The assessment would include the nature of the incident, apparent or confirmed hazards, estimate of casualties and assessment of resources to deal with the incident.
- Identify and activate the resources needed to respond. The Ambulance Control Centre would access and mobilise NHS resources as required.
- Manage the NHS activity at the scene. An Ambulance Incident Officer would be assigned for this task.

- Co-ordinate NHS communication and liaison. This would be between the Ambulance Incident Officer, the Ambulance Control Centre and other NHS control Centres and facilities.
- Treat casualties: Extricate, Triage, Stabilise, Initially Treat and Transport to Hospital.

GS-R-2 4.86: Radioactive waste and contamination shall be appropriately managed.

Environment Agency

A.9.65 The EA has a broad statutory role under the Environment Act 1995 to protect and enhance the environment as a whole - air, land and water - in England and Wales. In the specific context of nuclear emergencies, the EA regulates the management and disposal of radioactive waste arisings under the RSA 93, and also provides agreed support to its sponsoring Department, Defra - particularly by providing advice on environmental radiation protection to Defra and to other bodies including water companies and local authorities. In the event of an emergency in England or Wales, the EA would send representatives to the off-site facility and to other central Government centres, and would set up its technical assessment centre. If there were a discharge of radioactive substances to the water environment, the EA would arrange sampling and radiochemical analysis of those waters, with a view to protecting the environment and advising downstream users and abstractors. The EA would consider whether it might reduce the impact of such a discharge by managing the flows of regulated waters that are under its control, for example, by releasing water from reservoirs or altering river levels.

A.9.66 During the recovery phase, central Government may request through Defra that the EA provides a GTA to advise on decontamination and cleanup.

A.9.67 In the event of a nuclear emergency occurring outside the UK, the EA would additionally decide whether to invoke the UK's National Response Plan and to convene the UK's Technical Co-ordination Centre, and would then manage that Centre if it were convened.

Scottish Environment Protection Agency (SEPA)

A.9.68 SEPA has duties in Scotland under the RSA 93, for regulating the use and disposal of radioactive substances. In the event of an accident, SEPA would send representatives to the off-site emergency facility and would set up their own emergency response centres to assess the extent of the environmental contamination, to instigate appropriate environmental monitoring and to advise on, or take any necessary actions to mitigate the effects. SEPA would be the authorising agency for disposal of any radioactive wastes that may arise as a consequence of an accident and would advise on appropriate disposal methods. Also in the event of such an accident, the Water Services Unit of the SE, in consultation with SEPA, would give advice to the water authorities in Scotland that are responsible for public water supplies. SEPA would advise the water authorities on appropriate monitoring of water supplies.

GS-R-2 4.97: The transition from the emergency phase to long term recovery operations and the resumption of normal social and economic activity shall be planned and made

A.9.69 The UK has plans for recovery up to the reference accident level where it is possible that this could lead to off-site contamination. This planning is less detailed than is the case for the accident phase. This is because, unlike the accident phase where matters must be resolved quickly, during the recovery phase there would be more time for resolution of problems. The actual level of detail for recovery planning is a matter for local resolution in the light of local circumstances. For accidents above the reference accident level there is outline planning only for the recovery phase.

A.9.70 The planning is the responsibility of the nuclear site operator, working in co-operation with a local authority or several local authorities, as appropriate. All contingency planning is undertaken in accordance with the guidance on "combined response" contained in the Home Office publication "Dealing with Disaster - Third Edition" and the Scottish Executive publication "Dealing with Disasters Together". Operators review potential release scenarios to determine the scope of pre-planning for the recovery phase. Consequently, off-site plans contain outline strategies for dealing with the recovery phase. Plans include details of how any specialist resources and equipment needed might be either secured or brought in. Such plans are developed in conjunction with the existing nuclear response plans for the acute phase.

A.9.71 Recovery phase plans make clear that the same principles that apply to handling the media during the accident phase also apply during the recovery phase.

A.9.72 The nuclear site operator, working in co-operation with the local authority/authorities, ensure that the contingency plans maintained for the recovery phase are examined and approved by the organisations which would be involved in their implementation. This will in turn ensure that all are clear about their responsibilities and the tasks that they would be required to carry out. The plans are reviewed and exercised periodically.

A.9.73 Recovery phase plans contain many features that are common to the arrangements for all nuclear sites around the UK. In these circumstances, it is appropriate to draw up a specific framework for planning appertaining to the locality. Responsibility for drawing up this plan should fall to the nuclear site operators working in co-operation with the local authorities concerned. The model plan requires maintenance, examination and approval of the plans by the organisations responsible for its implementation at each locality. It is probable that the lead department for the accident phase (DTI for an accident in England or Wales, and Scottish Executive for an accident in Scotland), as the sponsoring department for the civil nuclear industry and the Nuclear Installations Act, would retain its lead department status throughout the entire period of response, including recovery. On this basis, it would also retain responsibility for appointing the SGLR during the recovery phase to provide the necessary central/local Government interface. The lead department would aim to ensure, as far as possible, that there was continuity of personnel from central Government between the accident phase and the recovery phase. However, changes may be necessary in the composition of the GTA team, or in the GTA personally. For example, it may be appropriate

to ask the EA or SEPA to provide a GTA to advise on the recovery phase to replace or supplement the Nuclear Installations Inspectorate (NII) official who would have overseen the accident control phase until recovery became the primary task. If the GTA is to be replaced, this should be done in a managed way, taking account of the need to provide continuity at the point when strategic command is transferred from the police to the local authority, as well as for a period afterwards.

A.9.74 For a reference accident scenario, it is likely that the local authority will coordinate the recovery phase. For very extreme accidents beyond the reasonably foreseeable accident scenario, where contamination effects are of such a scale as to affect a very large area (e.g. under the jurisdiction of a number of local authorities) or to demand the utilisation of large amounts of national or international resource, the Civil Contingencies Committee may be given the task of deciding, once the accident is brought under control, whether the management and co-ordination arrangements based on the Off-Site Facility (OSF) continued to be appropriate. It may also review the OSF's location and representation, and consider whether the lead department, GTA and SGLR roles should be redesignated. The outline plans prepared locally is capable of being extended to provide a basis for the necessary recovery activities.

A.9.75 It is for the operator working in conjunction with the local authority/authorities to decide the precise form the necessary plans should take. A possible model is
as follows. If it becomes clear that off-site contamination is going to occur, the Recovery Working Group (RWG) should be convened as soon as practicable. This would be in the early stages of an accident, shortly after the off-site contamination is detected. It is foreseen that this Group would operate from the OSF although other locations in proximity of the OSF would potentially be possible. The responsibility for ensuring that the RWG is convened rests with the OSF police coordinator, in consultation with the GTA.

GS-R-2 5.29: A national emergency facility or facilities shall be designated for the coordination of response actions and public information.

A.9.76 In addition to the local off-site facility, the lead Government Department would set up a Nuclear Emergency Briefing Room (NEBR) in London for emergencies in England and Wales or a Scottish Executive Emergency Room (SEER) in Edinburgh for emergencies in Scotland with communication links to the off-site facility. Any national response to an emergency and the briefing for central Government and Parliament would be co-ordinated at the NEBR or SEER. It would also be the focal point within central Government for preparing information for the media and the general public on the course of the emergency, on measures to protect people in the affected area and on any consequences for the public outside the affected area. Press or media enquiries not dealt with by the media briefing centre at the off-site facility could be handled by the lead Department's press office on the basis of material prepared by the NEBR or SEER.

A.9.77 Representatives of the principal Government Departments and Agencies attending the NEBR (or SEER) would include the DTI, Defra, the Department of Health (or appropriate departments for Wales), and the EA. The equivalent departments for Scotland and SEPA would attend the SEER. Representatives of the HSE, including its Chief Inspector of Nuclear Installations, and the NRPB would be present at either the NEBR or SEER. Representation at either the NEBR or SEER is shown diagrammatically at Figure 16.3.

A.9.78 Although the main source of information to the public would be the media, the lead Department would also be ready to deal with telephone queries put to it by the public; these would be referred to a public enquiry room which would quickly be established in London or Edinburgh. The public enquiry room would attempt to deal with as many calls as possible and would act in concert with other agencies, including the police, local authorities and NRPB, who would also expect to receive calls from the public.

A.9.79 The NEBR or SEER would also be the focus for briefing Government Ministers and departments and for co-ordination of departmental action, including the co-ordination of any additional resources that might be required.

A.9.80 The NEBR or SEER would take information from the Radiation Incident Monitoring Network (RIMNET) system operated by DEFRA. This provides a nation-wide system for detecting and monitoring radioactivity together with communications facilities, which enable information dissemination between central and local government and other official bodies. SEPA manages the Scottish end of RIMNET from its Head Office, and would staff the resource as necessary. Access to the RIMNET system would also be available at the SEER.

GS-R-2 3.5: The national co-ordinating authority shall make all reasonable efforts to foster the implementation by other States of [emergency arrangements] measures.

A.9.81 For any emergency at a nuclear installation in the UK the DTI in London would take the responsibility for notifying other countries and initiating requests for international assistance. Under existing early notification conventions, the DTI would inform the European Community, the IAEA, and countries with which the UK has bilateral agreements, about the accident and its likely course and effects.

GS-R-2 3.15: Any threat associated with nuclear facilities in other States shall also be considered.

A.9.82 Defra is the nominated first point of contact in the UK in the event of a nuclear accident overseas. RIMNET has been set up as part of the UK Government's National Response Plan for dealing with overseas nuclear accidents. It is operated by Defra and provides facilities for the collection and analysis of radiological monitoring data, necessary for the response to a nuclear accident. It also provides communications systems for distributing data summaries and Government information and advice bulletins.

A.9.83 RIMNET provides continuous gamma radiation dose rate measurements from over 90 fixed sites throughout the UK. In addition, it allows other key radiological monitoring measurements, necessary for accident response, to be directly input to a UK national database facility. These additional data would include measurements of radioactivity in air, food, water, other environmental materials and people. The design of RIMNET permits input of these additional data both by Government departments and other bodies approved by Defra. Data entry by the latter group is by way of computers linked to the RIMNET database via a public data network.

A.9.84 Measurements held on the RIMNET database will be used as a basis for decisions aimed to ensure the safety of members of the public within the UK. As such, they must be

adequately quality assured and reliable. They must also be supported by known and consistent techniques of sample collection and measurement. Only bodies that can demonstrate their ability to meet the necessary standards and to operate to RIMNET protocols are approved to supply data.

GS-R-2 3.15: In the threat assessment any populations at risk shall be identified and, to the extent practicable, the likelihood, nature and magnitude of the various radiation related threats shall be considered.

A.9.85 Emergency actions described here for nuclear installations are based upon the following principles:

(a) There is a 'detailed emergency planning zone' around each nuclear installation within which arrangements to protect the public is planned in detail. The boundary of this zone is defined in relation to the most significant release of radiation from an accident that can reasonably be foreseen; and
(b) Emergency planning for each nuclear installation needs to be capable of responding to accidents that, although being extremely unlikely, could have consequences beyond the boundaries of the detailed emergency planning zone. The measures that are required to extend the detailed arrangements cannot be precisely planned because the nature and potential of accidents may vary and the exact response would be based upon assessments made at the time. The response can make use of local and national plans prepared to deal with a range of emergencies of a non-nuclear nature.

END OF THIRD UK REPORT